



# EXPERIMENT STATION RECORD.

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## EXPERIMENT STATION RECORD.

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The employment of experiment stations as a basis for the sound development of agriculture has been a characteristic feature in the administration of the territorial possessions of the United States and has constituted one of the important forms of aid rendered to these dependencies. One by one these regions have been provided with stations, usually equipped and maintained chiefly by Federal appropriations, until an interesting and in some respects novel group has been developed.

Some of the noteworthy features of the stations in these insular possessions were outlined in these pages about ten years ago, at the time of the establishment of the station in the Island of Guam. The interval has been one of steady development, and the group is now to be extended by the addition of a station for the Virgin Islands.

The oldest of this group of stations is that located at Sitka, Alaska, which was established in 1898, after a preliminary survey of conditions and agricultural features of the coast country. The stations in Hawaii and Porto Rico followed in 1901, and the Guam station was opened in 1908 as mentioned above. They thus represent widely separated geographical areas, which mark the extremes in territorial expanse of the country with the exception of the Philippine Islands, and climatic conditions are presented ranging from the arctic zone to the tropics, with scarcely less radical differences in many other respects.

The administration of this group of stations, it will be recalled, differs materially from that of the experiment stations within the States. They receive no funds under the Hatch and Adams acts, nor are they directly connected with the agricultural colleges which have been provided under the Morrill fund in Hawaii and Porto Rico. They are maintained from specific annual appropriations carried in the appropriation act for the Department, and they are Federal stations supported almost exclusively by congressional appropriations, with no regular aid from the local governments. Originally established by the Department under the direct supervision of the Office of Experiment Stations, they are still administered through a division of insular stations of this Office as a part of the States Relations Service.

These stations and their environment, therefore, present many unusual features, which with the character of their special problems and the relatively pioneer conditions under which they are operating, lend special interest to them and to their success in developing and improving the agriculture of these outlying possessions.

The primary purpose of the stations in Alaska has been to work out the possibilities for agriculture in that northern region, and to develop types of farming suited to the country. The first station was located at Sitka, then the capital of the Territory, which has remained the headquarters of the agricultural work; but climate, soil, and other features differ so widely in Alaska that it was planned from the first to locate branches in various other sections, typical of conditions or the prospective opportunity for agricultural development. This plan has been followed, and there are now in operation additional stations at Rampart and Fairbanks in the interior some 400 miles back from the coast, on the Island of Kodiak near the entrance to Cook Inlet, and at Matanuska on the line of the Government railroad which is being constructed into the interior.

Plant breeding and the introduction and testing of varieties have occupied a large amount of attention in the Alaska work, and some very successful results have been secured through the introduction of economic plants from other countries of high latitude or elevation. Varieties of oats, barley, rye, and spring wheat have been secured from other countries that ripen during the average season, and the necessary period of growth has been reduced through selection and the development of hybrids. Varieties of barley have been produced that breed fairly true to type and that ripen from ten days to two weeks earlier than the parent plants. At the Sitka station, hybrid strawberries of excellent quality have been developed which have proved hardy not only for the coast region but also in the interior valleys. Much attention has naturally been given to vegetable growing, with such success that it has become widespread and is meeting local needs for a wide range of vegetable foods are now being produced. The stations have also introduced and established hardy alfalfas for the great interior valleys, and have added other valuable forage crops to the indigenous species.

For about ten years experiments with sheep and cattle have been in progress on Kodiak Island, and except for the interruption in 1912 due to the eruption of Mt. Katmai, sheep and Galloway cattle have been maintained almost wholly on locally produced forage and pasture. The Galloways have proved perfectly hardy, but as there is a demand for milch cows an attempt was begun in 1917 to produce a dual-purpose animal by making reciprocal crosses between the Galloway and the Holstein breeds.

With the construction by the Government of a railroad connectingeward and Fairbanks, Alaska, attention has been directed to the character of some of the regions through which it passes. Under the auspices of the Alaskan Engineering Commission, a reconnaissance survey of part of this Territory was made by the Bureau of Land Survey of this Department in 1914. In the Cook Inlet-Susitna region, there is reported to be more than a million and a quarter acres of land possessing topographic and drainage characteristics and chemical and physical properties quite favorable to farming. About one-fourth of this good land is to be found in the Susitna and Matanuska valleys.

In making appropriations for this Department for 1918, Congress authorized the establishment of an agricultural experiment station in the Matanuska Valley. In anticipation of such action, a preliminary survey of the valley was made in 1915 and a site for the station selected and reserved about two miles from Matanuska Junction, the point where the branch line from the Matanuska coal mines joins the main line. This tract, which embraces 240 acres, was made available for use as an agricultural experiment station by executive order dated September 20, 1915.

The entire area of the valley is more or less covered with birch and spruce timber, with cottonwoods along the creek bottoms. The soil is a silt loam that has been found by settlers to be fairly productive. Even before the railroad was begun there were some settlers in these valleys, and there are now several hundred homesteads in the vicinity of the station. This region differs from those in which the other experiment stations in Alaska are located in that it combines some of the continental features found in the interior valleys with the modified climatic conditions of the coast.

In the spring of 1916 some cooperative work was begun with a number of farmers to test various grains that had been produced at the Fairbanks station. On account of unavoidable delays and a very backward season early seeding was impossible, but several varieties of barley and oats proved well adapted to the region and quite satisfactory yields of hay and grain were reported. Some limited experiments with vegetables and small fruits have been undertaken, the results of which indicate that these also can be successfully produced in that region.

With the immediately available appropriation, work was begun in the spring of 1917 on the establishment of the Matanuska station. Mr. F. E. Rader, who had been formerly connected with the work at Rampart, was placed in charge at Matanuska, and the clearing of land, erection of buildings, fences, etc., was begun. By the close of the season, a number of acres had been cleared and prepared for

planting in the spring of 1918, and the immediately necessary buildings had been erected. The experimental field work will be begun this season. In the meantime, the cooperative work with settlers will be continued, not only to obtain data but to demonstrate what food crops can be produced for local consumption. Local markets, due to the railroad construction, are available, and every effort is being made to stimulate the production of those crops that experiments have shown can be reasonably expected to succeed.

The line to be immediately taken up by the station is that of adapting agriculture to the near-by valleys. Efforts will be made to test various field and garden crops and through breeding experiments to improve their adaptability to the region. Later it is expected to conduct experiments with live stock, as it is believed the valley where the station is located is well adapted to dairying.

The work in Alaska has been under strictly pioneer conditions, such as are rarely to be found at present in continental United States. There has been little to guide since so little had been done in the way of personal effort and so little confidence was felt in the possibilities of agriculture. It has been necessary therefore to determine the prospects for crop production, in addition to working out ways and means, which constitutes the main field of the experiment station. From the data now on hand it is believed possible to recommend with a fair degree of confidence the crops and vegetables that may be expected to succeed in all the more important agricultural regions.

In Hawaii, the problem chiefly demanding attention on the part of the station has been that of diversifying agriculture. No work has been done on the leading agricultural industry, sugar production, but much effort has been expended in trying to develop minor crops and thus to aid in establishing a permanent type of citizenship on the land. Much of the best agricultural land is held by estates or under lease to corporations, but there is abundant land for individual holdings if properly administered.

As the Hawaiian Islands are of volcanic origin, their soils present some rather unusual features, and soil studies have formed an important part of the station's work since its establishment. Surveys have been made of many of the more important soil types and their physical and chemical characteristics determined. In many of the soils a high manganese content is found, and such soils are adapted only to certain crops and special methods must be followed in handling them.

In connection with rice culture, which was an important industry when the station began its work, a study was made of the application

of fertilizers with the result that nitrate of soda, which was formerly extensively used as a fertilizer for rice, has been almost abandoned for this purpose and sulphate of ammonia is now employed as the principal source of nitrogen. Nitrate of soda was found to leach from rice soils and to have little or no residual effect, while the use of sulphate of ammonia was found highly advantageous.

The growing of pineapples for canning has recently become one of the large enterprises of the islands, the station having contributed very largely to the development of the industry. After the discovery of the injurious effect of a relatively high manganese content of the soil on the growth of pineapples, investigations were continued from which it was found that by spraying the plants four or five times during the growing season with a solution of iron sulphate yellowing was prevented and normal fruits produced. As a result of this discovery, at least 5,000 acres of land that had been abandoned for the cultivation of pineapples is being replanted to that crop.

The station has been active in the introduction of forage plants and improved varieties of grains, fruits, and vegetables, and in the prevention of losses through the control of plant diseases and insect pests. An experiment in cooperative marketing undertaken in 1913 in order to furnish an outlet for small quantities of produce of various kinds has proved quite successful, the sales increasing from \$2,500 in 1914 to over \$121,000 in 1917, when the marketing division was taken over by the Territory by which it is now maintained. Extension and demonstration work is being developed to some extent, especially on the island of Mani, where a considerable number of planters are located.

The Porto Rico Station, which is located at Mayaguez, has, since its establishment, given much attention to soils and their management. As many of the soils of the island are peculiar in their acidity and iron and lime content, and require special management to retain their fertility, experiments have been conducted in the laboratory and field to determine their characteristics and requirements. In connection with these studies, attention has been given to lime-induced chlorosis of cane and pineapples, and considerable data have been accumulated regarding the nature of the diseases and means for their control.

Fertilizer investigations in connection with the different soil types have been made for various crops. An extensive series of experiments on the availability of different forms of phosphates for use on Porto Rican soils is in progress, a preliminary report on some phases of the work having been made recently. A survey of the bat guano deposits in more than 100 caves has been completed and the available supplies have been determined. A number of improved

methods for water culture experiments worked out by the station have been described in scientific journals.

One of the early lines of endeavor of the station was in the improvement of live stock through the introduction of pure-bred animals. This work has proved very popular and the results are beginning to be apparent in many parts of the island. Experiments bearing on the sanitary production of milk are reported to have brought about great improvement in the quality of the milk supplies.

Attention has been given to the introduction of new crops and improved varieties of old ones with the result that many introduced varieties have to a large degree supplanted those previously grown. The value of introduced forage crops and the use of cover crops not only for the prevention of erosion but for the improvement of the soil, and the superiority of improved varieties of fruits, etc., have been fully demonstrated.

In horticulture, citrus and coffee culture have received much attention. Fertilizer and cover crop experiments with citrus trees have indicated improved practices that have been widely applied. With coffee the experiments have had to do with soils, fertilizers, pruning varieties, seed-bed and nursery treatment, diseases, and insect pests. Improved varieties of coffee have been introduced from other countries and some of them have proved especially adapted to Porto Rican conditions. Vanilla growing, an industry new to the island, has been developed, and it is possible that this will in time become of considerable economic importance. As very little cacao has been produced in Porto Rico, experiments are in progress that are expected to show the possibilities of developing cacao production on a larger scale. Experiments with coconuts have been in progress for a number of years, and data obtained regarding coconut culture will soon be available for publication.

As plant diseases and insect pests take heavy toll of agricultural and horticultural products in tropical countries, the Porto Rico station has given special attention to a number of problems in connection with life history studies and means of control of some of the more important plant enemies. Beekeeping, an industry owing its origin to the station, has been developed within the past ten years and now exports of apiary products valued at more than \$330,000 are reported for the nine months ended March 31, 1918. Demonstration and extension work have been developed to a small degree, especially of late, in order to secure larger local production of food crops. As a result of a campaign conducted by the station, Porto Rico during the past year, instead of importing beans valued at \$800,000 annually as in former years, supplied its own necessities and had a surplus of this product for export.

The Guam Station, which was established to aid in restoring the agriculture of the island to its former importance, has had satisfactory success in its efforts. In 1911, Morgan horses, Ayrshire cattle, Yorkshire pigs, and several breeds of poultry were received for use in building up the deteriorated live stock then found on the island. Since that time, other pure-bred animals, including Toggenburg goats, Berkshire pigs, and poultry, have been added to the equipment of the station; and although there have been losses due to various causes among the cattle, pigs, and goats, on the whole the experiment in improving the animals of the island has proved a valuable one, several hybrid races having been established which combine the hardiness of the native stock with the larger size and other desirable qualities of the pure-bred stock.

Some experiments have been carried on with locally produced feeds from which it has been found that within certain limits, breadfruit, dried coconuts, coconut meal, etc., can be substituted for imported or locally grown grain in feeding horses, cattle, pigs, and poultry. Preliminary to making the live-stock introductions, attention was given to the question of forage production, and a number of grains, grasses, and leguminous plants were secured from other countries and sent to the station. Some of these have succeeded remarkably, among them Para and Paspalum grasses, pastures and meadows of which have been established, not only at the station but on many native ranches. Sorghums for grain and forage have proved well adapted to the local conditions, and Sudan grass, a recent introduction, has given indications of great value as a forage plant. Velvet beans, cowpeas, jack beans, soy beans, peanuts, etc., are all being tested to determine their value for forage and as green manure and cover crops.

The station has introduced upland, Sea Island, and Egyptian cottons, and from several years' tests it seems probable that the growing of certain types can be made very profitable. Attention is also being given to problems connected with raising tobacco, the question of insect control appearing to be the limiting factor in successful tobacco production. As rice growing, once a large industry, has become of minor importance, the station has undertaken experiments in all phases of rice production in order, if possible, to restore it to its former place.

An attempt has been begun to improve the corn grown on the island. This crop furnishes the staple food of the people of Guam, being about the only cultivated crop that is extensively produced. Comparative tests with many varieties from other tropical countries, the native strains of corn appeared to offer more promise of successful improvement. Selection experiments were undertaken



with these, and several pure lines have been established that yield the parent varieties.

In horticulture, the chief experimental work has been the determination of the best seasons for planting various crops, the introduction of new vegetables and improved varieties of some of those already under cultivation, and the propagation of material for distribution among the people. As the sources from which seeds and plants may be obtained are limited, this work forms an important part in the station's activities. The Hawaii Station is cooperating most heartily in this work, and many of the best varieties of tropical fruits and vegetables found in Hawaii may now be obtained in Guam.

About 1907, the first hives of bees was introduced from Hawaii. These have done exceedingly well, having proved prolific and well suited to their surroundings. As a result of the success attained, instruction in beekeeping is given in connection with all the island schools, and many small apiaries have been established throughout the island.

The acquisition by the United States of the Danish West Islands has led to plans for the extension of experimental work to another tropical group. Provision for this was embodied by Congress in the bill making appropriations for the Department for 1919.

These islands, which were acquired from Denmark in 1916, lie to 50 miles east of Porto Rico. Only three of them are of importance, St. Croix, St. Thomas, and St. John, with an area of approximately 200 square miles and a population of about 36,000 people. St. Thomas and St. John are mountainous and contain little land suitable under present methods to extensive agriculture. St. Croix, the largest of the three islands, embraces most of the agricultural land, though some low mountains exist on the northern side of the island. The southern part is made up of fertile plains and low, rolling hills, being well adapted to modern agriculture.

Most of the agriculture now practiced is on St. Croix, with sugar cane and Sea Island cotton as the principal crops. On St. John there were formerly some sugar estates, but the cultivation of that crop has ceased to be of importance. St. Thomas is at present of little agricultural interest, as most of the population depends on the activities of the harbor for support. Bay rum is the only considerable product of this island. Lime and coconut trees occur in some numbers, but no systematic attempt appears to have been made to extend their planting.

The climate is said to be healthful, and the trade winds make living comfortable, especially during the cooler months. The coolest

rather is from January to March, when, in 1916, the maximum temperature was 82° F. and the minimum 65°. The hottest periods are August and September, when the maximum and minimum temperatures were 92° and 72° F., respectively. The rainfall is rather low for the Tropics, the average for 63 years being only about 50 in. on St. Croix and even less on the other islands. If agriculture were extensively developed, some provision for irrigating the crops would undoubtedly have to be adopted. A hurricane visited the islands on October 9, 1916, which is reported as having been the only very destructive one for 50 years or more. Property losses were estimated at \$1,000,000.

Upon the request of the Naval governor shortly after the acquisition of the islands by the United States, an agricultural survey was made of them by Mr. D. W. May, Agronomist in Charge of the Porto Rico Station. All the principal islands were visited, several weeks being spent upon them, and a report of the results of the survey with recommendations was made to the governor. Sugar and cotton were found to be the leading crops produced, with considerable areas also over to forage plants. The sugar output is about 20,000 tons annually, practically all of it being produced on St. Croix. Sea island cotton is second in importance, more than 2,000 acres having been planted to this crop in 1913. Insect ravages and difficulties consequent on the European War caused a marked falling off in the production of cotton, so that the growing of this crop was nearly abandoned. There is some attempt at cattle raising, which could undoubtedly be profitably increased. There appears to be very little attempt to grow fruits and vegetables, even for local consumption. In 1916, an agricultural experiment station was established on St. John, on a tract of 23 acres, two and one-half miles from Christiansted, the principal town of the island. This area has since been increased to 275 acres, about 190 acres of which can be cultivated. A laboratory and office building has been erected, and a considerable amount of equipment has been provided. Experiments are being made with sugar cane to determine the best varieties for local conditions and the fertilizer and cultural treatments required for the best yields. Some cotton experiments have also been begun, and considerable attention is given to the growing of sorghums, maize, sweet potatoes, and various leguminous plants adapted to use as green manure crops.

Since the change in sovereignty, the income of the station was curtailed, and the new Congressional appropriation makes provision for its maintenance under the management of the States Relations Service of the Department. It is expected that the present station will be taken over and the experiments now in progress continued and others in-

augurated. Some additions to the staff are planned, to permit the taking up of studies on soils, horticulture, and possibly live stock. It is believed that a considerable cattle industry could be developed especially on St. Thomas and St. John, and with it, dairying, which is almost unknown, could be profitably developed. Immediate attention to food production is desirable in order that the islands may be less dependent on the mainland for their maintenance.

These islands are advantageously located for the development of a large maritime shipping transfer, and it is believed with the return of normal times that they are destined to greatly increased prosperity in which agriculture can and should play an important part.

## RECENT WORK IN AGRICULTURAL SCIENCE

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

biochemical catalysts in life and industry.—Proteolytic enzymes, J. F. COLEMAN (New York: John Wiley & Sons, Inc., 1917, pp. XI+751).—This is a translation by S. C. Prescott, assisted by C. S. Venable, of the French text by J. F. Coleman (E. S. R., 32, p. 662).

The effect of potassium bromate upon enzym action, I. S. FALK and C. E. HENNING (Jour. Biol. Chem., 33 (1918), No. 3, pp. 455-462).—The action of potassium bromate upon trypsin and pancreatin was investigated by means of experiments with casein and determination of the amino acids produced, the presence of varying amounts of the salt. From the experimental results the authors conclude that "potassium bromate appears to exert a consistent influence upon the digestion of casein by trypsin in vitro in the following manner: At low concentrations (1:200,000) the action is stimulated, the action being most marked at bromate concentrations of 1:200,000. Potassium bromate in concentrations of one part or more appears to exert a slight inhibitive influence upon the digestion of casein by pancreatin, while in higher dilutions (1:200,000 or 1:250,000) it exerts a stimulating action."

It thus appears that in the strength in which it is used in Arkady Yeast (1:200,000) potassium bromate may exert a specific stimulating action upon the proteolytic enzymes active in the fermentation.

The new constituents of milk.—III, A new protein, soluble in alcohol, by G. L. GILBERT and A. J. WAKEMAN (Jour. Biol. Chem., 33 (1918), No. 2, pp. 101-110). The authors, in cooperation with C. S. Leavenworth and O. L. GILBERT, describe in detail the method of preparation and physical and chemical properties of the alcohol soluble protein of milk previously noted (E. S. R., 38, 1917). The protein was obtained by concentrating the alcoholic washings of a large quantity of casein which had been several times dissolved in 5% and precipitated by dilute hydrochloric acid. It was soluble in 10 per cent alcohol but insoluble in absolute alcohol and nearly so in water containing more or less inorganic salts.

The average composition of this protein obtained by a series of fractional precipitations was, on the ash- and moisture-free basis, as follows: Carbon 54.91, hydrogen 7.17, nitrogen 15.71, sulphur 0.95, phosphorus 0.08, and ash (difference) 21.18. The distribution of nitrogen, according to Hauschild's method, was amid nitrogen 1.56 per cent, basic nitrogen 2.55, and total nitrogen 0.21. The basic amino acids calculated by the Kossel method, per 100 gm. of milk protein, arginin 2.92 gm., histidin 2.28, lysin 2.47 gm., and tyrosin 2.47.

Compared with casein the alcohol-soluble protein contains more carbon and less phosphorus, basic nitrogen, arginin, histidin, and lysin. It does not resemble the alcohol-soluble proteins of vegetable origin in being characterized by a large proportion of amid nitrogen and less lysin than most proteins. The evidence that it is not related to casein was shown by negative precipitation reactions with casein although it is itself highly anaphylactogenic.

Other characteristic properties are its action as an acid compound, positive reaction with potassium ferrocyanid from a solution in dilute acetic acid, positive tryptophane, Millon's and biuret reactions, and solubility in relatively dilute alcoholic solutions.

"The possible existence of proteins of similar solubility ought to be considered whenever the complete removal of protein is necessary for the isolation of nonprotein nitrogenous substances of animal origin."

**A study of heat-coagulable and water-soluble protein of cow's milk.** PALMER (*Missouri Sta. Bul. 151 (1917), pp. 37, 38*).—In a study of the effect of milk proteins to their filtration through the Pasteur-Chamberland filter, it was found that only about 75 per cent as much nitrogen passes the filter when preserved with chloroform as when preserved with formalin. The total amount which passes through in the presence of either preservative or without any preservative at all does not exceed 25 per cent of the total casein nitrogen. The amount of albumin which passes through when formaldehyde is added to the milk was found to be only about 10 per cent of the albumin which may be obtained from the casein filtrate of the original milk when no acid is used as the protein precipitant.

The presence of chloroform in milk materially decreased the yield of albumin, especially after it had stood a few days.

In regard to the character of the proteins which invariably remain from heat-coagulable proteins have been removed, a review of the literature, methods of analysis and the preliminary work indicates that these proteins are merely the residues of albumin and globulin from the original milk which have been sufficiently decomposed during the removal of the casein with the heat to render them noncoagulable by heat and to alter their properties in other respects. No indication was obtained of the presence of proteoses and peptones. It appears that heat coagulation will have to be abandoned as a method of removing the albumin of cow's milk.

**A study of the dietary essential, water-soluble B, in relation to its solubility and stability toward reagents.** E. V. MCCOLLUM and N. SIMON (*Jour. Biol. Chem., 55 (1918), No. 1, pp. 55-89, figs. 12*).—This article reports a series of investigations conducted with the assistance of H. Stenbeck for the purpose of developing a new method of isolating water-soluble B depending upon its solubility in various organic solvents. Experimental data and growth charts are reported and results interpreted. The method was as follows:

Rats were used as experimental animals and were fed a diet of purified substances complete except that it was free from water-soluble B. Five per cent of butter fat was used to supply an abundance of fat-soluble A. The rats were confined to this mixture for about five weeks until they had become stationary in weight or were declining with evidence of paralysis. The mixture to be tested for water-soluble B was then added to the diet. The method was used to show within two weeks whether a sufficient amount of water-soluble B was in the preparation under investigation.

The authors feel that this method is more satisfactory as a test than the conventional method of curing polyneuritic pigeons since the element of variation as well as recovery, is introduced. In this connection, they offer the following alternative explanation for Williams' hypothesis (*E. S. R., 36, p. 314*): "A specific type of labile isomerism rather than a specific chemical complex accounting for the curative effects on polyneuritic pigeons of various related substances. 'The temporary relief of polyneuritis may be the result of the pharmacological action of certain substances rather than a response to the renewed function of cells which have been subjected to a selective fast'."

have been supplied with the missing food complex." Absolute proof that the biologically active dietary factor is being dealt with should include reproduction of growth and maintenance of health.

Experimental data show that the water-soluble B is not extracted directly from beans, wheat germ, or pig kidney by either benzene or acetone, but is readily extracted by alcohol. After being removed by alcohol it is readily soluble in benzene but very slightly soluble in acetone. That there can be physiologically indispensable substances in water-soluble B the fact that it is insoluble in acetone is not so improbable in view of the solubility relations with the three other fractions. The water-soluble B is relatively stable toward nitrous acid (an indication that it is neither a primary nor a secondary amine) and toward hydrochloric acid. It is rapidly destroyed by even moderately dilute alkalis, as has been shown by Voegtlin and others (E. S. R., 36, p. 464).

**Effect of time of digestion on the hydrolysis of casein in the presence of starch.**—S. McILHART (U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 1, pp. 1-15). This is a report of experiments conducted at the Kentucky Experiment Station in duplication of the work of Hart and Sure (E. S. R., 37, 1917), the effect produced on the hydrolysis of casein by the presence of starch, investigating the effect of varying the time of digestion.

Comparisons were made with casein alone and with a mixture of 10 gm. of casein and 50 gm. of starch. The periods of digestion were 12, 15, 24, and 48 hours. The Van Slyke method was followed in detail and the results of the experiments tabulated. From the data the author draws the following conclusions:

"The Van Slyke method for protein analysis, when applied to mixtures of casein and starch in the proportion of 1:5, and hydrolyzed from 12 to 15 hours with 20 per cent hydrochloric acid gives results for the amino-acid groups that are comparable with those obtained by Van Slyke upon casein alone. A longer period of more than 15 hours with 20 per cent hydrochloric acid on a starch mixture brings about a redistribution of the nitrogen contained in the histidin and cystin groups. The insoluble residue obtained from starch digestion after being thoroughly washed contains nitrogen, which is not seriously affected when distilled with calcium-hydrate suspension, the alcohols being split off as ammonia or remaining in the filtrate. It concludes that the nitrogen is in an inert form and its estimation should be included in the humin determination."

**A foam inhibitor in the Van Slyke amino nitrogen method.**—H. H. HART and H. C. ECKSTEIN (Jour. Biol. Chem., 33 (1918), No. 3, pp. 373-375). Diethyl ether is reported by the authors to be a very effective foam inhibitor in the Van Slyke nitrous acid method of determining aliphatic amino nitrogen in animal and plant extracts. A convenient procedure for preparing the extract at comparatively low cost is described.

**Nitrogen content of bacterial cells.**—I, Method, H. C. BRADLEY and M. S. BRADLEY (Jour. Biol. Chem., 33 (1918), No. 3, pp. 525-529).—An adaptation of a previously described biochemical method (E. S. R., 29, p. 508) was used for determining the nitrogen content of *Bacillus diphtheriae* and *B. hoffmanni*. The bacteria were grown on Loeffler's blood serum medium for 72 hours. The growth was harvested by a glass spade with rounded edges, transferred to tared cover glass and dried in a calcium chlorid desiccator at 37° C. for 72 hours. The digestion was done on an assay balance sensitive to 0.000,005 gm. The digestion mixture for each tube consisted of 2 gm. potassium sulphate, 0.2 gm. copper sulphate, and 5 gm. concentrated sulphuric acid. The digestion was continued for 15 minutes after the liquid had become colorless. The digest was made alkaline with sodium hydroxid, and the ammonia aspirated into

tenth-normal sulphuric acid. The nitrogen was determined by nesslerization as in the usual Folin method.

The results showed in *B. diptheria* 8.35 per cent of nitrogen, and in *B. hoffmanni* 9.75 per cent. The authors conclude that "it is possible to determine the nitrogen content of any bacterium which will grow on a solid medium without liquefaction of that medium, by this method, provided as much material as 5 mg. can be obtained."

A study of the nonprotein nitrogen of wheat flour, M. J. BLISS (*Jour. Biol. Chem.*, 33 (1918), No. 3, pp. 551-559).—The author, at the Montana Experiment Station, has applied the copper protein precipitation method reported by Osborne and Leavenworth (E. S. R., 37, p. 8) to the separation of protein from nonprotein nitrogen in flour extracts.

It was found that practically a complete separation may be accomplished in water extracts of wheat flour by treating the extract with tenth-normal sodium hydroxide followed by tenth-normal copper sulphate until there is slightly more copper sulphate than an exactly equivalent amount of sodium hydroxide. The author states that the method is simple of manipulation and permits of rapid filtration through ordinary filter paper, giving a clear solution which may be concentrated to one-twentieth its original volume for determinations of amino nitrogen by the Van Slyke micro method and for amid nitrogen determinations. The removal of true proteins is practically complete. Some peptid nitrogen is not precipitated and probably a considerable amount of nonprotein nitrogen which is neither amino-acid nor peptid nitrogen. Normal patent flour was found to contain about 2 mg. of amino-acid nitrogen for every 100 gm. of flour and about three times as much nitrogen in free acid amid form.

The method is thought to be applicable to studies of proteolysis or other studies involving the estimation of protein cleavage products in wheat flour, but probably will not be applicable to biological extracts from other sources than wheat and flour.

Copper-phosphate mixtures as sugar reagents. A qualitative test and a quantitative titration method for sugar in urine, O. FOLIN and W. S. MEILLOR (*Jour. Biol. Chem.*, 33 (1918), No. 3, pp. 513-519).—A qualitative test for sugar in the urine, employing alkaline phosphates for holding the copper hydroxide in solution, as suggested in a previous investigation (E. S. R., 36, p. 316), is described as follows:

One hundred gm. of sodium pyrophosphate, 30 gm. of crystallized disodium phosphate, and 50 gm. of anhydrous sodium carbonate are dissolved in about 1 liter of water. To this is added 13 gm. of copper sulphate previously dissolved in 200 cc. of water. The solution is used exactly as is Benedict's reagent for sugar. Minute traces of sugar are indicated by various grades of turbidity, larger amounts by precipitates of cuprous oxide. The test is said to be quite as reliable and sensitive as Benedict's and a trifle more prompt. Unless a marked turbidity is noted in the hot solutions, the result should be regarded as chemically negative.

The authors also describe a practical and inexpensive quantitative method for the titration of sugar in urine. The reagents are an acidified copper sulphate solution containing 60 gm.  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  per liter, and a dry mixture containing 100 gm. disodium phosphate crystals ( $\text{HNa}_2\text{PO}_4 \cdot 12\text{H}_2\text{O}$ ), 60 gm. dry sodium carbonate ( $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ ), and 30 gm. of sodium or potassium sulphocyanate. The titrations are made in test tubes, which are considered preferable to flasks because (1) the cost of chemicals is reduced, (2) the preliminary heating period is short, (3) there is no necessity of regulating the flame to a definite speed of boiling, (4) the disappearance of the last traces of blue color

is more sharply marked on account of the small volume, and (5) there is little or no return of any blue color at the end of the titration.

By means of a special capillary tip delivering from 45 to 55 drops of urine per cubic centimeter, the titration can be made on undiluted urine with an ordinary burette. The burettes are preferably filled by suction and the titration made by the drop system, starting with 25 drops of urine added to a clear solution obtained by heating 4.5 gm. of the dry salt mixture with 5 cc. of the copper sulphate solution. For accurate results the drops should be delivered not faster than 1 drop per second, and the portion of the burette most used should be calibrated.

The authors recommend for convenience of manipulation and for work involving very small amounts of material special 5 cc. burettes graduated in 0.02 cc. In the case of urines containing albumin, rather large test tubes should be used on account of foaming. The albumin alters the appearance of the cupreous precipitate, but does not change or obscure the end point of the titration.

The determination of lactose in milk, O. FOLIN and W. DENIS (*Jour. Biol. Chem.*, 33 (1918), No. 3, pp. 521-524).—The titration method of Folin and McEllroy, noted above, was found by the authors to be applicable to the determination of lactose in milk without preliminary removal of the protein materials. The method of procedure was practically the same as that described in the preceding paper, except that it was found advisable to dilute the milk 1:4 for cow's milk and 1:5 for human milk.

A colorimetric picrate method simpler than the one of Dehn and Hartman<sup>1</sup> was also used. The method is described in detail and a table given of comparative results with human and cow's milk of both the titration and colorimetric methods. Of the two methods, the authors believe the titration to be the more accurate, although the colorimetric method has the advantage that by means of it a large number of determinations can be made more or less simultaneously.

A new microscopic method of counting bacteria adaptable to all grades of raw and pasteurized milk, P. W. ALLEN (*Jour. Infect. Diseases*, 22 (1918), No. 3, pp. 245-251, fig. 1).—The method consists of adding to the milk to be tested a water suspension of aluminum hydroxid which readily collects the bacteria. By centrifuging, the precipitate is thrown down and can be easily separated from the fat, casein, and water. It is dried to a thin microscopic film on a glass slide and stained with methylene blue, for which the hydroxid has slight affinity. A bacterial count is made, using an oil immersion lens.

The method is described in detail and tables of its accuracy reported. From the data the author concludes that about 95 per cent of the bacteria in the average sample of milk appears in the hydroxid thrown down by centrifugation.

Detection of peanut oil in oils and fats, D. J. DE JONG (*Pharm. Weekbl.*, 54 (1917), No. 47, pp. 1390-1393; *abs. in Chem. Abs.*, 12 (1918), No. 5, pp. 536, 537).—From experimental data a comparison is made of the relative value of three methods of detecting peanut oil in commercial oils: (1) That of Jean, recommended in the Dutch Pharmacopœia for testing olive and sesame oils, in which the oil is saponified with alcoholic potassium hydroxid and kept at 18° C., a precipitate appearing within an hour indicating the presence of 10 per cent or more of peanut oil; (2) that of Franz-Adler, previously noted (*E. S. R.*, 30, p. 14); and (3) the solidification point method. The Bellier and Renard-Arcbutt methods are also discussed.

<sup>1</sup> *Jour. Amer. Chem. Soc.*, 36 (1914), No. 2, pp. 403-409.



The authors conclude that for rapidity and accuracy the Franz-Adler method is the best, although it can not be used to detect peanut oil in lard and cottonseed oil. The solidification method is not sensitive enough, as but little difference is shown with large variations in peanut-oil content. In the Renard-Archbutt method 10 per cent of peanut oil can barely be detected.

A study of the solubilities of liquids in liquids. The partition of the lower alcohols between water and cottonseed oil, B. B. WORTH ([*Gettysburg Pa.*]: Author, 1917, pp. 21, fig. 1).—"The partition ratios of methyl, ethyl, propyl, isobutyl, and isoamyl alcohols between water and cottonseed oil at 25° C. are found to be 103.6, 28.3, 6.41, 1.7, and 0.47, respectively. These are found to change regularly with increased number of carbon atoms. The solubilities of methyl and ethyl alcohols in cottonseed oil are 4.84 and 21.2 gm. per 100 cc. of oil."

A special nomon for calculating the purity of sugar solutions, A. P. BLAKE (*Internat. Sugar Jour.*, 20 (1918), No. 230, pp. 73-78, fig. 2).—The author has constructed a special form of the nomon, previously noted (E. S. R., 38, p. 204), for the rapid determination of the "exponent" of sugar solutions. This exponent is the sucrose percentage of the solid matter and is determined by the following equation:

$$\text{Exponent} = \frac{\text{polarisation} \times 26}{\text{specific gravity} \times \text{Brix.}}$$

In the special form of nomon a scale has been constructed with the degrees Brix indicated at the point corresponding to the respective values of the factor

$\frac{26}{\text{specific gravity} \times \text{Brix.}}$  All data on the regular chart which are not required have been eliminated.

It is the author's intention to work out other applications of the nomon to the numerous calculations of the sugar industry.

Determination of water in sugar factory products by means of the distillation method, T. VAN DER LINDEN, M. KAUFFMAN, and F. LEINTRA (*Arch. Suikerindus. Nederland. Indië*, 25 (1917), No. 22, pp. 951-962, fig. 1; *Meded. Proefstat. Java-Suikerindus., Chem. Ser. No. 3* (1917), pp. 12, fig. 1; also in *Internat. Sugar Jour.*, 20 (1918), No. 230, pp. 89, 90).—The method described consists of distilling 50 gm. of the sample with 350 cc. of xylol. The water is carried over with the distillate and is measured directly in a 250-cc. measuring cylinder graduated to twentieths of a cubic centimeter. The distillation is regulated that about 100 cc. pass over in three quarters of an hour and 100 cc. more in the next quarter hour, at the end of which time the distillation is stopped. A meniscus correction for xylol and an apparatus correction for the small loss of water have to be made.

The method is considered satisfactory, but requires very careful attention.

Solubility of calcium sulphite in water and in sugar solutions, T. VAN DER LINDEN (*Rev. in Internat. Sugar Jour.*, 20 (1918), No. 230, p. 91).—Previously noted from another source (E. S. R., 38, p. 716).

Preservation of Virginia fruits and vegetables, EDITH A. ROBERTS (*Polytech. Inst. Ext. Bul.* 17 (1917), pp. 48, figs. 4).—In this bulletin, issued in cooperation with the U. S. Department of Agriculture, the author has compiled from various sources extensive material on the different methods of the preservation of fruits and vegetables. A number of recipes and charts for the cold-pack process and for making preserves and catsups, as well as suggestions for the arrangement and equipment for canning by the cold-pack method, are included.

**Preservation of unfermented grape juice**, S. F. ANDERSON (*Jour. Agr. [New York]*, 16 (1918), No. 1, pp. 32-36, fig. 1).—The object of this article is to assist producers in preparing and placing on the market a pure, wholesome, and nonalcoholic vinous juice." The principles involved in the preservation of unfermented grape juice and the methods of operation and utensils required are discussed. The directions are particularly applicable to the output from a small vineyard.

**Improvements in methods of pickling olives**, F. T. BIOLETTI and W. V. CRESS (*California Sta. Bul.* 289 (1917), pp. 195-200, figs. 4).—This bulletin suggests improved methods for pickling olives, while still adhering to the theory of treatment with lye and oxidation to darken the color. The new methods are subject to better control and are much quicker. They have been used successfully in the laboratory and in some cases in factory tests.

The methods suggested are a combination of continual movement of the liquid with continual aeration, high temperature and circulating liquid, aeration by compressed air with the use of hot standing liquid, and a combination of the above principles of aeration, circulation, and high temperature. The last is considered a very rapid and satisfactory method. Descriptions of the methods and diagrams of the necessary apparatus are given.

The possibility is suggested of subjecting ripe olives to a method of fermentation similar to that used in the preparation of "Queen" olives. Two methods are outlined, in one of which the ripe olives are pickled without exposure to air and then fermented. In the other method olives pickled by the darkening process are fermented. The two methods are said to combine the good qualities and avoid the defects of the present green and ripe olives.

## METEOROLOGY.

**The meteorological resources of the Empire**, H. G. LYONS (*Abstr. in Nature [London]*, 100 (1918), No. 2517, pp. 416, 417).—Attention is called to the great diversity of meteorological conditions and requirements in the British Empire, the need for better organization and coordination of meteorological agencies, and the necessity for developing an efficient corps of specially trained men for meteorological work.

It is stated that "the work of the meteorologist does not end with recording the pressure, or the temperature, or the monthly amount of the rainfall, but meteorological observations, after being taken, must be worked up into the various forms in which they will be most useful for shipping, agriculture, water supply, engineering, sanitation and health, and now, also, aerial transport. The same form will not suffice for all, and meteorology itself has its own special needs, but the important thing is that this information, however accurate and detailed it may be, will not be available in exactly the forms that answer to different requirements unless there is a sufficient staff of trained meteorologists to handle it and to supervise its preparation."

**Report of the chief of the Weather Bureau, 1917** (*U. S. Dept. Agr., Weather Bur. Rpt.*, 1917, pp. 291, pls. 7).—This contains (1) an administrative report summarizing the work of the Weather Bureau during the year, (2) a review of weather conditions during 1918, including also sections giving detailed data on sunshine and excessive rainfall, and (3) monthly and annual summaries of pressure, temperature, precipitation, and related data for 1918, and of monthly and seasonal snowfall for 1918-17. Attention is called particularly to the extension of the activities of the bureau for the time being to two primary projects, namely, "the forecasting of the weather for purely military operations, and the sounding of the upper air for the benefit of aviators, bal-

loonists, and artilleryists." Brief statements are made regarding the organization and various activities of the division of agricultural meteorology.

**Climatological data for the United States by sections** (*U. S. Dept. Agr. Weather Bur. Climat. Data, 4* (1917), Nos. 3, pp. 240, pls. 2, figs. 6; 10, pp. 226, pls. 2, figs. 4).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1917, respectively.

**Meteorological summaries** (*Kentucky Sta. Rpt. 1915, pt. 1, pp. 73-75*).—Tables are given which show monthly and annual temperature and precipitation at Lexington, Ky., for 1872 to 1915, inclusive, as well as temperature and precipitation extremes, wind, cloudiness, and casual phenomena for 1915.

**Meteorological observations at the Massachusetts Agricultural Experiment Station**, J. E. OSTRANDER, T. H. REUMAN, and A. L. CHANDLER (*Massachusetts Sta. Met. Buls. 347-348* (1917), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1917, are presented. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

**Pressure**, reduced to freezing and sea level (inches).—Maximum, 30.6, December 17; minimum, 28.93, February 5; mean, 30.010. **Air temperature**, in ground shelter (degrees F.).—Maximum, 98.5, July 31; minimum, -22.5, December 30. **Humidity**.—Mean dewpoint, 38.4; mean relative humidity, 78.1. **Precipitation**.—Total rainfall or melted snow, 43.56 in.; number of days on which 0.01 in. or more rain or melted snow fell, 117; total snowfall, 58 in. **Weather**.—Total cloudiness recorded by sun thermometer, 1,770 hours, or 40 per cent. number of clear days, 129. **Bright sunshine**.—Number of hours recorded, 2,684, or 60 per cent. **Wind**.—Prevailing direction, west; total movement, 44,653 miles; maximum daily movement, 611 miles, April 11; minimum daily movement, 1 mile, September 20, November 30; maximum pressure per square foot, 35 lbs., April 10, northwest. **Dates of frost**.—Last, May 18; first, September 11. **Dates of snow**.—Last, April 27; first, November 24.

**The climate of Tennessee**, R. NUNN (*Resources Tenn., 8* (1918), No. 1, pp. 7-45, figs. 7).—This article discusses briefly the physiography and soils and crops of Tennessee in their relation to climate, and summarizes in notes, tables, and diagrams the outstanding climatic features (temperature, precipitation, humidity, sunshine, and cloudiness, and length of growing season) of the different sections of the State.

In general the climate of the State is said to range from mild to temperate and is comparatively free from great extremes of temperature, sudden weather changes, and severe storms. The rainfall is abundant but not excessive, the humidity moderate, and sunshine and cloudiness well distributed through the year. The ground rarely covered with snow for more than a few days at a time and the crop-growing season is long as compared with that of the northern and western sections of the United States. The comparatively equable climate of the State is due in part to the fact that it does not lie within any of the principal storm tracks.

**Climate and meteorology** (*Canada Yearbook, 1916-17, pp. 176-183, fig. 1*).—The characteristic features of the temperature, precipitation, winds, and bright sunshine for the Dominion of Canada during each month of the year 1916 are described, and tables are given which show the temperature and precipitation during 1916 at representative stations in Canada as compared with the normal annual averages for the period from 1888 to 1907, inclusive.

**Meteorological records at Ottawa, W. T. ELLIS** (*Canada Expt. Farms Rpts.* 1916, pp. 3, 4).—Tables based on observations at the Central Experimental Farm, Ottawa, are given showing the maximum, minimum, and mean temperature, the rainfall, snowfall, total precipitation, number of rainy days, heaviest precipitation in 24 hours, and sunshine, for the period from April, 1915, to March, 1916, inclusive, also the annual rainfall, snowfall, and total precipitation from 1890 to 1915-16 with the averages for the period.

**The fertilizing value of rain and snow, F. T. SHURT** (*Canada Expt. Farms Rpts.* 1916, pp. 174-178).—Data are reported for the ninth year of this investigation (E. S. R., 36, p. 19).

The total precipitation for the year amounted to 33.65 in. as compared with an average of 32.81 in. for the 9 years of the investigation, but the total nitrogen, amounting to 9.765 lbs. per acre, was considerably in excess of that found in any previous year. Of this amount 4.87 lbs. occurred as free and organic ammonia and the remainder as nitrates and nitrites. The cause of the increase has not yet been fully explained.

### SOILS—FERTILIZERS.

**Soils (Missouri Sta. Bul. 151 (1917), pp. 55-59, 62-65, figs. 2).**—Brief progress reports are made on various soil fertility experiments as follows:

M. F. Miller and F. L. Duicy report further work with corn, the results of which confirm those of previous experiments in showing that "the period from the time of laying by to the time of silking is the most important to final growth from the standpoint of both moisture and nutrition. . . . The water requirement is less influenced by variations of the moisture supply during the growing period than it is by the character of the season. In the case of the variation in moisture supply less concordant results are available than in the case of the variation nutrients."

The results of investigations by M. F. Miller and R. R. Hudelson on the rate and manner of applying fertilizers to corn were adversely affected by the dry season but indicated that heavy applications of fertilizers in the row actually injured the corn. Applications of fertilizers in the row at the second cultivation gave better results than earlier applications. "The fertilized plots all showed more vigorous early growth than the unfertilized plots."

In tests by Miller and Hudelson on various ways of handling cowpeas as a preliminary crop for wheat there was "very pronounced benefit from the seeding of cowpeas between the wheat crops when plowed under, disked in, or when the cowpea crop was taken off. The yields have always been better on the plots in which the peas are disked in and the wheat sown afterward. Bedding after plowing under peas does not seem to be of much help."

In comparative tests by Hudelson of various phosphates in a rotation of corn, wheat, and clover the relative order of effectiveness has been found to be bone meal, calcined phosphate, basic slag, acid phosphate, and rock phosphate.

From studies by W. A. Albrecht of the nitrogen content of soils as affected by storage, the conclusion is drawn that soils absorb ammonia from the air. The increase of nitrogen from this source varied from a few pounds to as much as 1,550 lbs. per acre, while the observed changes in nitrogen content due to bacterial action were within the limits of experimental error. An outline is given of an experiment which has been undertaken on nitrate production in soil as affected by crops and cultivation.

In crop rotation and fertilizer experiments carried on by Miller and Hudelson corn grown continuously has shown a six-year average yield of 11.14 bu. per acre as compared with a yield of 28.52 bu. for corn grown continuously but

receiving 7 tons of manure annually. Corn in rotation yielded 44.2 bu. per acre, and corn in rotation receiving 7 tons of manure annually, 54.55 bu. per acre. Manure has maintained oat and timothy yields better than crop rotation, while wheat grown continuously and manured annually has yielded slightly more than wheat grown continuously and receiving commercial fertilizers. Corn grown in rotation has been maintained at about the same level of yields by heavy applications of manure as by heavy applications of commercial fertilizers. The return from manure has been greater on corn, oats, wheat and timothy grown continuously than on these crops grown in rotation.

Soil moisture studies by Miller and Duley led to the conclusion that the effects of loosening the soil on increased absorption was more important than that of decreased evaporation.

Cooperative work with the U. S. Department of Agriculture in soil mapping, and with agencies outside the station in soil and crop experiments is briefly noted.

Studies in soil reaction as indicated by the hydrogen electrode, J. K. PLUMMER (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 1, pp. 19-31). This article reports experiments made at the North Carolina Experiment Station with the hydrogen electrode as a means of indicating soil reaction on a number of untreated soils in suspension. "The soils experimented with represent a wide range in texture of those common to the area of the southeastern portion of the United States, extending from and including the Appalachian Mountains to the Atlantic Ocean. The H-ion concentration varies from almost 'true neutrality' to rather excessive 'true acidity' in the soils.

"With the Morgan apparatus for extracting film water from soils [*E. S. R.*, 37, p. 717], it is shown that its reaction is the same as the free water, differing only in intensity.

"The effects of certain fertilizers on the H-ion concentration of long-time-treated plats of three soils have been measured with the following results: (1) Ammonia sulphate has materially increased the H-ion concentration of all plats which have received applications of this material. The acidity thus developed extends often to the subsoil. (2) Sodium nitrate has slightly reduced the acidity of the plats to which it has been applied. (3) Potassium sulphate increases the 'true acidity' when applied to soils, though not as greatly as ammonium sulphate. (4) Acid phosphate does not appear to have affected in either direction the H-ion concentrations of field soils. (5) Lime materially increases the OH-ion concentration of field plats to which it has been added.

"The acidity developed from ammonium sulphate is more intense in the film than in the free water of three soils. Monocalcium phosphate does not change in any way the soil-film water until excessive amounts are added."

Hydrogen-ion concentration measurements of soils of two types: Caribou loam and Washburn loam, L. J. GILLESPIE and L. A. HUBER (*Soil Sci.*, 4 (1917), No. 4, pp. 313-319).—Studies on the hydrogen-ion concentration of Caribou loam and Washburn loam soils from Aroostook County, Me., are reported.

It was found that these soils possess broadly differing biological characteristics before cultivation. "Cultivated soils of the Caribou loam type exhibit, when examined by the colorimetric method, considerably greater hydrogen-ion concentrations than do soils of the Washburn loam type. The average hydrogen-ion exponent for the Caribou loam was found to be 5.2; that of the Washburn loam 5.93. The possibility is indicated that the relative freedom of the Caribou loam from potato scabs may be due to its greater hydrogen-ion concentration."

**Soil survey of the San Fernando Valley area, Cal.,** L. C. HOLMES, E. C. ECKMANN, G. L. HARRINGTON, J. E. GUERNSEY, and C. J. ZINN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 61, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the University of California, deals with the soils of an area of 175,360 acres, situated in southwestern California, and embraces practically all the San Fernando Valley and a part of the lower mountain slopes and foothills along its margins. Physiographically, the valley, or main portion of the area, is an oval basin. The somewhat regular and smooth side slopes consist of "merging alluvial fans which usually are very sharply differentiated in topography from the hills and mountains flanking their upper sides."

The soils of the area have been broadly grouped in three main provinces with respect to their origin, as follows: "(a) Residual soils or those occupying the hills and mountains and derived by weathering in place from consolidated rocks, (b) coastal-plain and old valley-filling soils or those derived from unconsolidated yet old, weathered, water-laid deposits, and (c) recent-alluvial soils or those of the recent-alluvial fans and valley slopes, this group being by far the most important." The first group is represented by 7 soil types of 4 series, the second by 4 types of 1 series, and the third by 22 types of 4 series. In addition to the above, three miscellaneous classes of material are mapped, namely, rough broken land, rough stony land, and riverwash. Rough stony land, rough broken land, Yolo loam, and Tujunga fine sandy loam predominate, occupying 13.7, 11.4, 8.9, and 6 per cent of the total area, respectively.

**Soil survey of Howard County, Md.,** W. T. CARTER, JR., and J. P. D. HULL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the Maryland Geological Survey, deals with the soils of an area of 161,920 acres, located in the central part of the State. Physiographically the county is a thoroughly dissected plateau. The area lies chiefly within the northern division of the Piedmont Plateau, the southeastern one-sixth of the county lies within the Coastal Plain.

"The soils of Howard County may be classed in three groups, namely, residual soils, formed by the disintegration and decomposition of the underlying rocks of the Piedmont Plateau; soils of the Coastal Plain, derived from sedimentary material deposited on a former ocean bed; and alluvial soils, consisting of recent sediments deposited along the various streams of the county." Thirteen soil types of 10 series are mapped. Chester loam, including the stony phase; Manor loam, micaceous phase; and Congaree silt loam, predominante, occupying 50.5, 18.7, and 10.4 per cent of the area, respectively.

**Soil survey of Bottineau County, R. C. DONOHUE** (*North Dakota Sta. Bul. 24 (1917), pp. 115-148, map 1*).—This survey has been noted (*E. S. R., 38, p. 422*).

**Soil survey of Kay County, Okla.,** N. M. KIRK and R. C. JUBNEY (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 40, pl. 1, fig. 1, map 1*).—This survey deals with the soils of an area of 602,240 acres in north-central Oklahoma, lying wholly within the Great Plains region. The topography of the county is level to gently undulating and undulating, the eastern portion being somewhat hilly. Drainage is well established.

The upland soils of the county are mainly residual in origin, being derived from limestone and shale, while some are of eolian origin and were derived from material from the river bottoms. The soils of the first and second bottoms are of alluvial origin. Twenty-eight soil types of 13 series are mapped, Gerald silt loam, occupying 40.3 per cent of the area, predominating.

**Further studies of the nature of ammonification,** K. MIYAKE (*Soil Sci., 1 (1917), No. 4, pp. 321-325*).—Further studies on the subject (*E. S. R., 38,*

p. 518) are reported dealing with ammonification in Caribou silt loam and Washburn silt loam from Maine, Superior clay from Wisconsin, Scottsboro silt loam from Indiana, and soil from the Arlington Farm, Virginia. Leucine and tyrosine were used as the chemicals to be ammonified and were added to 100 gm. of soil in amounts equivalent to 100 mg. of nitrogen.

It was again confirmed that "the process of ammonification is an autocatalytic chemical reaction and that the increase of ammonia in the process is in accordance with the formula:  $\text{Log } \frac{x}{A-x} = K(t-t_1)$ .

"The total amount of nitrogen added to be ammonified does not transform into the nitrogen in the form of ammonia in the process of ammonification. The amount of nitrogen transformed into ammonia nitrogen is greatly influenced by both the soils and chemical compounds used."

**Total nitrogen and carbon in cultivated land and land abandoned to grass and weeds.** A. W. BLAIR and H. C. McLENNAN (*Soil Sci.*, 4 (1917), No. 4, pp. 288-293, fig. 1).—"It is pointed out that the average nitrogen content of land which was allowed to run wild from 1908 to 1916, and which during this period received annual applications of dried fish amounting to 600 lbs. per acre was essentially the same in 1916 as in 1913. (No samples were collected previous to 1913.) The carbon content of this same land was increased slightly during the period 1913 to 1916.

"The average nitrogen content of adjoining cultivated plots, under a 5-year rotation, was 0.02 per cent less in 1913, and 0.023 per cent less in 1916, than the nitrogen content of the corresponding plots that were allowed to run wild. The average nitrogen content of the cultivated plots was slightly less in 1914 than in 1913.

"The average carbon content of the cultivated plots was approximately 0.2 per cent less in 1913 and 0.3 per cent less in 1916 than the average carbon content of the corresponding plots allowed to run wild. The average carbon content of the cultivated soils was slightly less in 1916 than 1913.

"The two cultivated plots which received no nitrogen (the check plots) yielded, in the crops from these plots, an average total of 196.13 lbs. of nitrogen for the 9 years. The six nitrogen-treated plots yielded, during the same period, an average total of 329.94 lbs. of nitrogen in the crops from these plots. There was recovered from the six nitrogen-treated plots for the 9-year period an average of 36.36 per cent of the nitrogen that was applied.

"The percentage of nitrogen and carbon in the cultivated soils is decreasing even where dried fish is applied at the rate of 600 lbs. per acre annually. The percentage of nitrogen in the soils allowed to run wild, and which have received annual applications of nitrogen, appears to run about constant, but the percentage of carbon is increasing slightly. Much volunteer white clover is appearing on the two plots which receive minerals but no nitrogen."

**Loss of organic matter in clover returned to soil.** G. E. BOITZ and C. J. SCHOLLENBERGER (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 12, pp. 397-400).—Experiments somewhat similar to those previously noted (*E. S. R.*, 36, p. 324) were made to determine the loss of organic matter and nitrogen in a crop of clover subjected to different methods of farm practice. A quantity of dried and finely cut clover amounting to 4 tons per acre was thoroughly mixed with the surface 6 in. of soil of duplicate plots, and the same amount of uncut clover spread upon the surface of each of two other plots after spading, all plots being covered with a wire screen immediately after treatment. The experiment extended over a period of 187 days, and samples of soil, clover, and clover residues were analyzed at the beginning and at the end of the period.

The average loss of carbon from the clover left on the surface was 48.38 per cent, and from that incorporated in the soil 34.28 per cent. A previous experiment showed losses of 66.05 and 28.45 per cent, respectively. No loss of nitrogen was indicated where the clover was incorporated with the soil, and although some nitrogen leached out of the clover applied to the surface of the soil, it was nearly all retained in the soil beneath.

Comparing the results of these experiments with those of previous experiments with manure, it is concluded that, eliminating "the comparatively small amount of fertilizing elements lost in metabolic processes when feeding clover to farm animals, and considering the carbonaceous matter only, there is little to be gained by plowing the crop under, as compared with feeding it and applying the manure. . . .

- While it is advisable to grow cover crops to be plowed under in the spring, in order to conserve the nitrates formed in the autumn and early spring, it is doubtful whether it pays to grow a crop during the summer months for green manuring, except when it could be used to good advantage for feeding purposes and the organic matter returned to the soil in the form of manure."

**Decomposition of green and stable manures in soil.** R. S. POTTER and R. S. STUBBS (*U. S. Dept. Agr., Jour. Agr. Research, 11 (1917), No. 13, pp. 677-698, Apr. 9*).—This paper is the third of a series of reports of investigations on this subject made at the Iowa Experiment Station (*U. S. R., 38, p. 118*).

The conclusions reached from experiments with stable and green manures applied in dry and ground condition are that "lime in the form of a carbonate under the conditions of this experiment appreciably enhances the rate of decomposition of both original soil organic matter and the organic matter of stable manure and the green manures, oats and clover, when added to soil. Two of the more important results of this are the increased availability of plant food and the more rapid depletion of the soil organic matter. This latter effect could be partially and perhaps entirely offset by the fact that with lime larger crops could be grown which would give more organic matter to return to the soil. The green manures, oats and clover, under the conditions of this experiment are decomposed much more completely than stable manure. Clover is decomposed somewhat more rapidly than oats. Stable manure increases the rate of decomposition of green manure when used in connection with the latter. Both stable and green manures act as conservers of lime."

In experiments in which the green manures and stable manure were applied in the fresh condition, the decomposition of the original organic matter in the soil was increased and that of the added manure decreased by liming. The net result, however, was an increased decomposition due to liming.

"The carbon of stable manures is evolved as carbon dioxide from soil under unlimed conditions to the extent of approximately 55 per cent. The carbon of oats under like conditions is evolved to the extent of 79 per cent and that of clover 95 per cent. Under unlimed conditions the amount of stable-manure carbon evolved is only slightly less than under limed conditions, while only about 57 per cent of the carbon of oats and 53 per cent of the carbon of clover is given off under limed conditions. All the manures tended to conserve the lime. Under unlimed conditions stable manure did not increase the rate of decomposition of the green manure as measured by the evolution of the carbon dioxide. With lime there was a slight increase in the amount of carbon given from the green manure when used with the stable manure over that given by the green manure when the latter was used alone. It should be recalled that in the former experiment stable manure enhanced the rate of decomposition of the green manure only to a slight extent. There is not a very great difference



in the rate of decomposition of the green manure when added in a finely ground, dry state and when used fresh and in a relatively coarse state of subdivision.

A bibliography of the subject is given.

Ten wheat fields in "Egypt"—A story in figures, C. G. HOPKINS, J. E. WHITCHURCH and H. F. T. FAHRENKOFF (*Illinois Sta. Circ. 208* (1917), pp. 2).—Wheat grown on poor soil on 10 fields in southern Illinois, where the Illinois system of permanent fertility (E. S. R., 23, p. 17) is practiced, showed an average yield for 1917 of 8 bu. per acre from the land itself and of 20.5 bu. from soil enrichments, such as manure, plant residues, limestone, phosphate rock, and kainit.

Fertilizer experiments, F. T. SHUTT (*Canada Expt. Farms Rpts. 1916*, pp. 159-169).—This reports and discusses the results obtained during 1915 in a continuation and extension of systematic experiments with fertilizers in different parts of Canada, previously noted (E. S. R., 36, p. 24). Numerous preliminary tests are in progress to determine the value of Atlantic coast seaweeds as a nitropotassic fertilizer.

The proper season for application of fertilizers to sugi (*Cryptomeria japonica*) and hinoki (*Chamaecyparis obtusa*) seedlings and the efficacy of fertilizers, S. MORIYA (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915*, pp. 34-41).—Experiments on loamy soil rich in humus, using ammonium sulphate, sodium nitrate, rapeseed cake, and night soil as nitrogenous manures and sodium phosphate and potassium sulphate, are reported. The total application of nitrogen, phosphoric acid, and potash amounted to 112.5 kg. per hectare (about 100 lbs. per acre).

It is concluded that the fertilizers used are more effective when applied at the proper times than when repeatedly applied at other times. "The efficacy of base manures was especially noted both for sugi and hinoki. . . . The best example of the base manure both for sugi and hinoki is observable. . . . for ammonium sulphate, Chile saltpeter, rapeseed cake, where one-third of the entire quantity was given as base manure in a few days previous to the planting of seedlings, while the rest was given as the top-dressings in two times, viz, in the middle of September and early in May, next year." The best effect was obtained with night soil when the entire quantity was applied before planting. With sugi the second best result was obtained for ammonium sulphate, rapeseed cake, and night soil where one-half of the entire quantity was given at first as base manure, while the rest was given in September, and for Chile saltpeter where the entire quantity was given at four different times, viz, at first as base manure, the beginning of June, the middle of September, and early the next June.

"Among the manures applied ammonium sulphate showed the best results for both trees and rapeseed cake the worst. With sugi, night soil showed better results than Chile saltpeter, but it was just the opposite in the case of hinoki."

The cause of the injurious effect of sulphate of ammonia when used as a fertilizer, R. W. RUPRECHT and F. W. MOSEY (*Massachusetts Sta. Bul. 176* (1917), pp. 119-134, pl. 1).—In continuation of similar work previously noted (E. S. R., 34, p. 622) the authors describe laboratory investigations with field soils to determine the relations between sulphate of ammonia and salts of aluminium, iron, and manganese, particularly the latter, and pot and water culture tests to ascertain the quantities of these salts which will injure clover seedlings.

Based on the results obtained in these and the former studies, it is concluded that "the positive presence of soluble salts of iron, aluminium, and manganese in soils which have been repeatedly dressed with ammonium sulphate without adding lime; the formation of one or more of these salts in soils that were

attracted with solutions of ammonium sulphate; and the positively injurious action of manganese sulphate, iron sulphate, and aluminium sulphate on seedling plants in water cultures and pot cultures when taken together form a chain of facts which clearly indicates that the injurious effects of sulphate of ammonia, when used freely without the accompaniment of lime, are due to the formation of these soluble salts in the soils of the fields so dressed." Furthermore, it is stated that "in the presence of calcium carbonate, water has removed no observable amounts of aluminium or manganese salts, and bare traces of iron salts, indicating that lime either reacts with the ammonium salt directly, or subsequently breaks up the salts of aluminium and manganese, and also iron salts, almost completely."

Electrochemical atmospheric nitrogen fixation industry, O. SCARPA (*Ann. Chim. Appl. [Rome]*, 7 (1917), No. 1-4, pp. 27-37, figs. 25).—This is a detailed description of the manufacture of nitrates by the direct oxidation of atmospheric nitrogen, the synthetic production of ammonia, and the production of nitric acid by ammonia oxidation.

Method of sale of nitrate of soda to farmers by the United States Government (*U. S. Dept. Agr., Office Sec. Circ. 78* (1918), pp. 11).—An outline is given of the plan of procedure promulgated by the Secretary of Agriculture for the sale and distribution of nitrate of soda to farmers by the United States Government, under authority of the Food Control Act (*E. S. R.*, 37, p. 808).

Nitrogen from sewage, S. RIDEAL (*Canad. Engin.*, 32 (1917), No. 7, p. 157; *ibid. in Chem. Abs.*, 11 (1917), No. 7, p. 859).—The author states that an enormous bulk of nitrogen is wasted in sewage and that ammonia may be recovered therefrom by heat or by aeration. If activation is carried on in the presence of lime, it is thought that some ammonia may be recovered with air. The further opinion is expressed that nitrogen may also be recovered from the effluent of sprinkling filters by evaporation in special beds.

Acid phosphate v. raw rock phosphate, C. E. THORNE (*Mo. Bul. Ohio Sta.*, 1 (1917), No. 12, pp. 390-393).—The superiority of acid phosphate over raw rock phosphate when applied in equal amounts, both alone and in combination with muriate of potash, lime, or manure, is thought to be fully demonstrated in experiments involving rotations of corn, oats, and clover conducted at Webster for thirteen years, and of corn, wheat, and clover in progress for 20 years, as indicated by both crop and money returns based on values prevailing up to 1914 and on current values. An experiment recently established involving a rotation of corn, oats, wheat, and clover, and in which 480 lbs. of acid phosphate and 768 lbs. of raw rock phosphate, representing equal money values are used, in addition to 8 tons of manure, has given the same relative results.

Domestic supplies of potash, E. H. JENKINS (*Connecticut State Sta. Bul.*, 125 (1917), pp. 45-52).—The average percentages of potash, phosphoric acid, and in some cases lime and other constituents, are given for Canada hardwood ashes, ashes from household fires, corncobs, brush heaps, brick kilns, witch-hazel stills, brass mills, smokehouses, and seaweeds, and the value of these materials as well as of salt marsh and river-meadow hay and farm manure as sources of potash is discussed.

Emphasizing the importance of saving all the wood ashes from stoves and fireplaces, the author states that "too much can not be said of the value of the 'open fire' in the house, whether in city or country. Aside from its value for heating and ventilation, it should be more used than it is as a 'destructor' for many kinds of wastes, recovering from them the most of what has any value. A hot fire will dry and consume with no annoyance much of the kitchen waste of the day, or if the waste is buried at night in the hot ashes

it will dry and be consumed in the next fire. . . . While the amount of potash in the wastes themselves is relatively very small, the percentage of potash in their ashes is in some cases surprisingly large."

Recent analyses at the station show the following percentages of potash and phosphoric acid in the ashes of certain common vegetable wastes:

*Potash and phosphoric acid in the crude ashes of common vegetable wastes.*

Kind of vegetable waste.	Potash.	Phosphoric acid.	Kind of vegetable waste.	Potash.	Phosphoric acid.
	Per cent.	Per cent.		Per cent.	Per cent.
Apple pearings.....	11.74	3.08	Orange skins.....	27.04	1.8
Banana stalks, yellow....	49.40	2.34	Peanut shells.....	6.46	1.2
Banana stalks, red.....	46.64	2.04	Potato peelings.....	27.25	1.4
Banana skins.....	41.76	2.25	Corn-cobs.....	17.25	1.4
Grapefruit skins.....	20.64	2.58	Cigar ashes.....	16.81	1.2
Lemon skins.....	31.00	6.30			

The fertilizing value of some household wastes, P. E. BROWNING (*Jour. Indus. and Eng. Chem.*, 9 (1917), No. 11, p. 1043; *abs. in Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 9 (1918), No. 1, p. 42).—Ash analyses, made in cooperation with J. P. Street of the Connecticut State Experiment Station, are reported. These include those noted in the preceding abstract, except the analysis of red banana stalks and corn-cobs, as well as the following additional analyses:

*Potash and phosphoric acid in the crude ashes of some household wastes.*

Kind of vegetable waste.	Potash.	Phosphoric acid.	Kind of vegetable waste.	Potash.	Phosphoric acid.
	Per cent.	Per cent.		Per cent.	Per cent.
Cantaloup rinds.....	12.21	9.77	Tea leaves.....	0.44	1.4
Boiled sweet potato skins.	13.89	3.29	Dried coffee grounds.....	.67	.1
Pea pods.....	9.00	1.79	Lamb chop bone.....	1.62	2.1
Cucumber skins.....	27.20	11.28	Egg shells.....	.29	.1
String bean strings and stems.....	18.09	4.99	Peach stones.....	6.04	1.1
			Peach skins.....	20.76	6.1

Nitrogen determinations are reported in the case of the dried coffee ground (1.99 per cent), and lime determinations in the case of the lamb chop bone (32 per cent) and egg shells (52.12 per cent).

Inspection of commercial fertilizers, H. D. HASKINS, L. S. WALKER, W. J. ALLEN, and R. S. SCULL (*Massachusetts Sta. Control Ser. Bul. 8* (1917), p. 64).—This reports the results of actual and guaranteed analyses of 626 official samples of commercial fertilizers and fertilizer materials, representing 41 distinct brands offered for sale in the State and inspected during 1917. The chemical character of the raw materials, mixed fertilizers, and acid phosphate is discussed, and the quality of the nitrogen, phosphoric acid, and potash contained in the fertilizer mixtures indicated.

Fertilizing materials, F. T. SHURT (*Canada Expt. Farms Rpts. 1916, p. 125-139*).—This reports analyses of limestones and marls from various parts of Canada and of miscellaneous materials, including fertilime, limekiln refuse, calcareous deposits from rivers and lakes, tanbark ashes, stone meal, pond mud, bone char, cotton-mill waste, and starfish.

## AGRICULTURAL BOTANY.

Leaf product as an index of growth in soy bean, F. M. HILDEBRANDT (*Johns Hopkins Univ. Circ.*, n. ser., No. 3 (1917), pp. 202-205).—The author emphasizes the statement that the relations established by McLean (E. S. R., 35, p. 800), first, that the leaf product (the sum of the products of length by breadth of all the leaflets on a soy bean plant four weeks old) is approximately proportional to the total leaf area of the plant; and, second, that this leaf area is itself nearly proportional to the total dry weight of stem and leaves, applies generally to the soy bean data obtained at nine different localities in Maryland.

In order to utilize the method proposed by Livingston and McLean (E. S. R., 35, p. 732) of employing the growth rates of standard plants as climatic indices, and in order to keep the plants so utilized alive and uninjured, soy bean leaflets were employed according to methods which are briefly described. As these leaflets are approximately elliptical in form, and as the area of an ellipse is proportional to the product of its axes, the sum of the individual leaflet products of a soy bean plant (the total leaf product for that plant) should be approximately proportional to its total leaf area.

It is noted that this proportion does hold in case of soy bean plants four weeks old. The dry weight of stem and leaves of this plant is found to be approximately proportional to the total leaf area. It is, thus possible, by multiplying the proper constant by the leaf area, to calculate the dry weight of the plant. The soy bean may thus prove to be suitable for use as a standard plant for the measurement of climate, as its growth can be determined from easily obtained leaf measurements.

Seasonal variations in the growth rates of buckwheat plants under greenhouse conditions, E. S. JOHNSTON (*Johns Hopkins Univ. Circ.*, n. ser., No. 3 (1917), pp. 211-217).—The present study was undertaken with special reference to its applicability in physiological experimentation in plant growth, which may show itself to be subject to puzzling variations due to changing conditions in the greenhouse as the seasons change.

Japanese buckwheat (*Fagopyrum esculentum*) was employed in connection with Shive's three-salt nutritive solution (E. S. R., 34, p. 333; 36, p. 328). A set of similar water cultures was started every two weeks, and each continued for four weeks, so as to allow successive sets to overlap, several different kinds of measurements being made each week.

The data, as tabulated, show the growth rates to vary in general independently from period to period, although increase of weight and increase of area correspond rather closely, both giving high rates for summer and low rates for spring and autumn. So far as these data may be taken as an indication, there is nothing in the usually uncontrolled conditions in a greenhouse in this climate that might be expected to produce a regular march of growth rates in height for buckwheat during spring, summer, and autumn. There is a general agreement between increase of dry weight and of leaf area.

It appears from the considerations as presented and discussed that by employment of such a method as the present one the climatic plant-producing power of any four-week period may be directly compared with that of any other such period at any time or place, the standard plant being used as an automatically integrating instrument for the measurement of the effective climatic conditions, as has been suggested by Livingston and McLean (E. S. R., 35, p. 732; 36, p. 800).

The effect of aeration on the growth of buckwheat in water cultures, E. E. FAXZ (*Johns Hopkins Univ. Circ.*, n. ser., No. 3 (1917), pp. 198, 199).—Water cultures of buckwheat in the solution found by Shive (E. S. R., 34, p. 333) to

be the best for that plant were subjected to several gases and to air by different methods.

The cultures supplied with oxygen, nitrogen, and air showed no departure from open controls or cultures sealed in accordance with the method employed by Briggs and Shantz (E. S. R., 25, p. 214), growth rate and dry matter production being essentially the same and practically all the plants setting seed. The degree of aeration of buckwheat appears to be of little influence under such conditions. This point, it is thought, may be of value in general water culture practice. The plants continuously treated with carbon dioxide wilted in a few hours and died in a few days. A test with the admission of air after the first day resulted in a partial recovery, although the plants remained permanently smaller than the controls.

The effect of deficient soil oxygen on the roots of higher plants, B. E. LIVINGSTON and E. E. FREE (Johns Hopkins Univ. Circ., n. ser., No. 3 (1917), pp. 182-185).—During the last three years, experiments have been in progress regarding the oxygen requirement of the isolated and controlled root systems of higher plants, the aerial portions being exposed to the atmosphere.

The response of the root systems apparently differs greatly with the species. The first noticeable effect of oxygen deprivation is an interference with water absorption by the roots, complete cessation occurring in 24 hours in case of *Coleus blumei* and *Heliotropium peruvianum*. Examination of the root systems of injured plants showed them to be dead and in some portions disintegrated. *Coleus* may be revived and may form a new system of roots, which always starts from the base of the stem. The earliest symptoms of injury appear on plants having the largest root systems. Apparently the crucial condition is limitation of the oxygen supply per unit of root surface or volume.

The evidence suggests that the cause of injury by oxygen exclusion is an interference with the respiration of the protoplasm of the root cells. The success of *Salix* under deprivation of oxygen raises the question whether the respiration of its roots may not be anaerobic.

The effects of certain mineral poisons on young wheat plants in three-salt nutrient solutions, E. E. FREE and S. F. TRELEASE (Johns Hopkins Univ. Circ., n. ser., No. 3 (1917), pp. 199-201).—The authors, having experimented with wheat plantlets in the nutrient solution found by Shive (E. S. R., 34, p. 333) to be the best for the production of dry weight of tops in case of wheat, give the results in tabular form, with discussion.

Most of the elements employed failed to show any stimulating effects. It is suggested that the solution employed is itself slightly toxic because of its high magnesium content. It produces plants showing modifications characteristic of magnesium poisoning, but gives the best yield of dry weight. This, with other observations, suggests that the best production of dry matter by a plant occurs as a result of slight poisoning. Work on the Canada field pea is said to have confirmed this suggestion in some degree. Apparently either magnesium or boron will serve, and it is suggested that other poisons may prove to be as efficacious in this respect.

Symptoms of poisoning by certain elements in *Pelargonium* and other plants, E. E. FREE (Johns Hopkins Univ. Circ., n. ser., No. 3 (1917), pp. 195-198).—In tests made by the author regarding symptoms of poisoning shown by *P. zonale* and other plants under the action of poisonous elements in different concentrations, it was found that arsenic, barium, bromine, cobalt, copper, lead, manganese, nickel, silver, uranium, vanadium, and zinc showed no determinable poisonous effect for any concentration with any plant employed. Manganese and zinc slightly improved both color and condition in *Pelargonium*. Arsenic

in higher concentrations produced a slight but unmistakable stimulation of growth in case of this plant, but it is suggested that this may have been due to a resulting greater availability of the phosphorus or of other soil nutrients. Pronounced and very specific toxic effects followed the use of boron, chromium, iodine, lithium, and mercury, and it is thought that it may be possible to recognize a poisonous ingredient in plants, as in animals, by its effect on the organism.

Certain features of the localization of injury in the plants suggest a relation to transpiration, that is, the poison's being carried into the plant incidentally by the transpiration stream and producing injury only when and where evaporation sufficiently increases concentration in a local tissue area. Chromium may prove to be an exception in this regard.

Sterilization of popcorn, R. O. BARGHAM (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 190-193).—Requiring several sterile seeds of popcorn for work in progress on the availability of nitrogen from certain organic compounds in sterile and in inoculated cultures for the growth of plants, the author carried out experimentation from which he concludes that mercuric chlorid, even at very low concentrations and for short durations of time, is toxic to popcorn seedlings, but that sulphuric acid (sp. gr. 1.84) used to treat the seeds for four minutes is the best disinfectant so far tested. While about 90 per cent of the seeds were free from organisms, yet absolute sterility could not be obtained as some fungi probably lie too deep in the seed coat to be reached by the disinfectant.

The presence of ammonia and of ammonium salts in plants, T. WEEVERS (*Rec. Trav. Bot. Néerland.*, 13 (1916), No. 2, pp. 63-104).—Previous study of potassium in plants (E. S. R., 28, p. 823) having led to a similar study of the localization of ammonium, the author gives in considerable detail the results obtained with different plants by the employment of a method, the limitations of which are indicated.

In the phanerogams investigated, free ammonia was found only in the root nodules. Among the cryptogams, it was found in some of the Hymenomycetes (*Clitocybe infundibuliformis*) and lichens (*Peltigera canina*). Ammonium salts were found in all species with the exception of certain forms growing in marshy soils. At a given time of the year, like portions of plants of the same species gave sensibly the same percentages, the influence of habitat appearing to be slight.

A method for approximating sunshine intensity from ocular observations of cloudiness, F. M. HILDEBRANDT (*Johns Hopkins Univ. Circ.*, n. ser., No. 3 (1917), pp. 205-208).—This method, as briefly described, is based upon the assumption that, while solar radiation affects plants in other ways than through its heating effect, by far the greater part of the sunshine energy absorbed by plants is converted into heat (largely as latent heat of the vaporization of water). It seems probable that the total of the other effects produced upon the plant may be more or less proportional to the total energy equivalent of sunshine. The method of measurement of light here described, although only a rough approximation depending upon the heating effect of the sunshine, is said to have given numbers rather definitely correlated with plant growth.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from October 1 to December 31, 1914 (U. S. Dept. Agr., *Bur. Plant Indus. Inventory No. 41* (1917), pp. 67, pls. 4).—This is an inventory of seeds and plants imported, mostly from Asia, during the period from October 1 to December 31, 1914, about 370 numbers being reported upon.

## FIELD CROPS.

[Report of field crops work in Kansas, 1915-16] (*Kansas Sta. Rpt. 1916*, pp. 12-14, 32-34, 36-38, 39-42).—This reports the progress of variety, cultural, and fertilizer tests with grain and forage crops conducted at Manhattan and on the various substations, in continuation of similar work previously noted (*E. S. R.*, 36, p. 181).

An application of 2.5 tons of manure increased the yield of wheat grown continuously 35.2 per cent for a 5-year average, and of alfalfa grown continuously 80.2 per cent. An annual application of 5 tons increased the average yield of alfalfa 118.1 per cent, and 2.5 tons of manure supplemented by 380 lbs. of rock phosphate, 97.4 per cent. Manure produced higher yields with alfalfa than commercial fertilizers, although the difference was not so great where alfalfa was grown in rotation as where it was grown continuously. Complete commercial fertilizers and potassium sulphate have not proved profitable for any crop.

Corn after corn preceded by alfalfa yielded 70.8 bu. per acre; after wheat preceded by corn, 63.9 bu.; after wheat preceded by cowpeas, 66.2 bu.; and grown continuously, 52.7 bu. Wheat after corn yielded 19.5 bu. per acre; after cowpeas, 15.27 bu.; and grown continuously, 12.75 bu. The highest wheat yields were again obtained from the earliest methods of seed bed preparation. The variations in nitrate nitrogen accumulation in soil following various methods of seed bed preparation appeared to be physical, in the activity of those organisms bringing about cleavage, hydrolysis, or oxidation of native proteins.

P-762, a hard winter wheat, outyielded Turkey and Kharkof by 2.60 and 3.46 bu. per acre, respectively, for a 5-year average. A strain of Red Texas oats produced on the average 3.5 bu. more per acre than the best variety previously grown.

Medium early seeding for oats at the rate of 2.5 bu. per acre, and the seedling of wheat about October 1 with a rate of 6 pk. per acre, were deemed best. Corn grown on plats left uncultivated, but with the weeds removed by hand, gave practically as high yields as that on plats cultivated three times in the ordinary way.

In silage tests, sweet sorghum was first with a yield per acre of 23.6 tons of silage and 21.4 bu. of grain, kafir corn second with 16.6 tons of silage and 54.4 bu. of grain, and commercial white corn third with 15.4 tons of silage and 74.5 bu. of grain. Sudan grass sown on May 15 and June 16 gave average yields of 3.64 and 2.8 tons of cured hay per acre, respectively.

Seeding experiments with wheat at the Fort Hays substation indicated that early seedings should be made at low rates and late seedings at high rates. Of the grain sorghums tested, Dwarf milo was first with a yield of 59.8 bu. per acre. Date-of-planting tests with sorghums for grain and forage showed that kafir corn and feterita did best when planted June 1, while saccharin varieties such as Freed, Minnesota Amber, and Red Amber grown for forage alone, produced best when planted June 15. The thickest planting rate, 4 in. apart in the row, proved best for both feterita and Red Amber in 1915. The 1914 and 1915 yields showed a decided advantage in favor of close-drilled Red Amber as compared with cultivated rows for hay, while feterita planted in alternate rows yielded only two-thirds as much fodder and grain per acre as was obtained from 4-in. spacings in regular rows. Of 52 varieties of sorghums tested, Red Amber was considered best for forage and Dwarf Yellow milo best as a general purpose variety. The quality of Sudan grass hay was deemed best when the crop was cut in the full-head stage, and the optimum time for planting was found to be from May 10 to 15. Legumes in Sudan grass mixtures failed entirely in 1914 and 1915. Tunis grass is said to be unsatisfactory. German millet

proved to be superior to other millets for the past three years, but is inferior in both yields and quality to Sudan grass.

Alfalfa tests conducted in the dry uplands since 1903 indicate that only occasional stands can be obtained, although the crop is an unquestioned success on the bottom lands of western Kansas. Annual legumes have not proved profitable either for hay or for seed, but Tepary beans offer some promise.

The highest yields of barley, oats, and spring and winter wheat were again obtained on disked corn ground. Kafir corn and milo maize gave the best results with fall or early spring plowing.

Winter wheat sown on summer-tilled land on the Garden City substation produced the highest yield, 21.3 bu. per acre. Land subsoiled every three years failed to give increased yields over land not subsoiled. Winter wheat sown on disked corn ground produced 16.8 bu. per acre, and that on disked potato ground, 14.8 bu.

The highest yields of spring wheat, 16.1 and 17.4 bu. per acre, were obtained from disked corn land and summer-tilled land, respectively. The highest oat and barley yields, 56.7 and 45.3 bu. per acre, respectively, were obtained on summer-tilled plots. Fall plowing for oats resulted in a yield of 23.8 bu., and spring plowing one of 37.2 bu. Barley yields for these methods amounted to 31.2 and 31.4 bu. per acre, respectively. The highest yields of Dwarf milo were obtained on land tilled in the fall, and amounted to 41.9 bu. of grain and 1,200 lbs. of stover per acre, with yields of 33.2 bu. of grain and 3,300 lbs. of stover on fall-plowed land. Spring plowing showed much lower yields.

In variety tests with sorghums for grain, Dwarf Yellow milo was first with 43 bu. per acre. Sumac was first in yield of forage with 17,200 lbs., and Orange second with 15,800 lbs. Kafir corn grown on fall-plowed plants produced 4.3 bu. more grain and 1,309 lbs. more stover per acre than that grown on fall-tilled plots. Summer-tilled land produced 45.6 bu. of corn and 4,000 lbs. of stover; spring-tilled, 35.6 bu. of grain and 2,500 lbs. of stover; spring-plowed, 11 bu. of grain and 2,730 lbs. of stover; fall-plowed, 23.4 bu. of grain and 761 lbs. of stover; and subsoiled, 30.5 bu. of grain and 2,970 lbs. of stover. Red White Dent was first in corn variety tests with a yield of 47 bu. per acre. Kharkof and Turkey Red were the best winter wheat varieties tested, with a yield of approximately 16.5 bu. Marquis and Kubanka, with average yields of 11 and 10.6 bu., respectively, were the highest yielding spring wheat varieties tested. The highest oat yields were 24.4 bu. for Kherson and 20.2 bu. for Red Texas, and from Common Six Row and Common California for barley.

The most profitable yields of cereal crops were obtained with a winter irrigation of 6 in. followed by a second application of from 4 to 6 in. when the wheat was in the boot stage. With forage crops one winter and two summer irrigations, totalling 12 in. of water, are deemed sufficient, while alfalfa was found to require an application for each cutting. The estimated cost and net profit for irrigation where the water must be pumped 130 ft. are indicated for trial field tests with alfalfa, winter wheat, oats, and Sudan grass both for hay and seed.

In corn variety tests on the Colby substation, Freed White Dent, Pride of Albion, Ford County White, and Bloody Butcher, with yields ranging from 42.6 to 39.7 bu. per acre, were highest. Kanred winter wheat yielded 34.25 bu., as compared with 33.66 bu. for local Turkey. Bearded Fife and Black Macaroni spring wheats yielded 30 and 31.4 bu. per acre, respectively. Red Amber sorghum was the only variety to mature good seed in 1915.

Freed White, Red Amber, Black Amber, Dakota Amber, and Minnesota Amber, with yields ranging from 15 to 20 bu. per acre, were the only sorghum varieties to produce grain in 1915 on the Tribune substation. Pink kafir,



Amber and Orange sorghums, and Schrock kafir produced the heaviest yields of forage, ranging from 8 to 5.8 tons per acre. An early prepared seed bed is deemed best for sorghums, while fallow is not regarded as being advantageous. Summer fallow for wheat proved to be the only method to insure a crop, except the partial fallow system or double spaced corn stubble. For summer tillage, a listed fallow is deemed superior to a plowed fallow. Turkey wheat, grown in a rotation with sorghum and fallow produced 22.2 bu. per acre, while other tests of alternate fallow produced yields of only 10 and 5 bu., respectively, for listed and plowed fallows. Nebraska Calico, Cassel White Dent, Moore Calico, Freed White Dent, and Towner White Dent, with yields ranging from 64.4 to 61.2 bu. per acre, were the highest yielding corn varieties tested. Corn on a fallow seed bed produced an average of 31 bu. per acre, and after wheat, 39.4 bu. Sown in rows 84 in. apart, corn has given larger yields than when sown in rows 42 in. apart, in average years, but in 1915 both methods produced an average yield of 27.2 bu. per acre.

Mexican and Tepary beans have each yielded about 8 bu. per acre for three seasons. Of the potato varieties tested, New York Rurala, Pearl, Green Mountain, Triumph, and Irish Cobbler yielded from 73 to 115 bu. per acre in 1915.

Western Orange and Red Amber sorghums are deemed best for forage on the Dodge City substation, while Pink kafir and Yellow milo (when free from chinch bugs) have produced good yields of grain. Western corn varieties have produced an average of 51 bu., and eastern varieties of 35 bu., per acre.

Sudan grass sown in cultivated rows 44 in. apart at the rate of 6 lbs. per acre yielded 400 lbs. of seed per acre. Sown at the rate of 22 lbs. it yields 6,500 lbs. of field-cured hay per acre.

Applications of from 3 to 20 tons of salt per acre have been made upon bindweed-infested areas. A rate of 10 tons is deemed sufficient to kill the weed, provided the small spots where the weed grows up are resalted.

[Report of field crops work at the Missouri Experiment Station, 1916-17], C. A. HELM, J. B. SMITH, W. C. ETHERIDGE, E. M. McDONALD, and RICHARD HOLMES (*Missouri Sta. Bul. 151 (1917), pp. 40-44, 62, fig. 1*).—This briefly reports the progress of work continued along the same general lines followed in preceding years (*E. S. R.*, 37, p. 780), embracing cultural and variety tests with soy beans, cowpeas, alfalfa, oats, barley, corn, wheat, and forage crops at various experimental centers in the State.

Of 84 varieties of soy beans tested for seed production at Columbia the highest-yielding varieties were Morse with 23.8 bu., Austin with 23.4 bu., Virginia with 27.2 bu., Mikado with 26.1 bu., and Columbia with 25.6 bu. per acre. At Maryville, Peking, Sable, and Black Beauty were the leading varieties, with yields of 16.9, 15.4, and 14.9 bu. per acre, respectively. At Warrensburg 9 varieties were tested for hay production, the leading varieties with their respective acre yields of cured hay being as follows: Mikado 3.9 tons, Wilson 3.6, and Black Beauty 3.5. Cultural tests at Columbia indicated that better yields of seed and hay were obtained from plantings in 8-in. rows between June 1 and 15, with the seed drilled in at the rate of 42 lbs. per acre.

In variety tests with cowpeas for hay production at Columbia, Groat, Whip poorwill, Clay, Coffee, and Red Ripper were the leading varieties, and at Warrensburg and Maryville, Whippoorwill. In cultural tests at Columbia the largest yields of hay were obtained by drilling in the seed at the rate of 45 pk. per acre in rows 16 in. apart.

Alfalfa variety tests indicated a marked superiority of northern-grown seed over southern-grown seed.

The highest-yielding oat varieties at Columbia were Green Russian, Blue Four, White Russian, and Kherson, with yields of 30, 28.6, 23.2, and 27.8 bu.

per acre, respectively. At Maryville the leading varieties included Great Dakota with 47.7, Kherson with 46.9, Red Rust Proof with 45.1, and Early Champion with 40.2 bu. per acre. At Warrensburg the fall-plowed oat plats yielded nearly 12 bu. per acre more than either early spring-plowed plats or disked plats. In rate-of-seeding tests the minimum yield, 27.9 bu. per acre was obtained, with a seeding rate of 4 pk. and the maximum yield, 34.6 bu., with a seeding rate of 12 pk. All winter oat varieties winterkilled at Columbia.

Yields of spring barley amounting to 22.7 and 21.5 bu. per acre were obtained at Maryville and Warrensburg, respectively. All varieties of winter barley winterkilled.

The corn variety tests have been reported upon in detail elsewhere (E. S. R., 36, p. 135). Further studies of factors influencing the development of the corn plant, including the effects of competition between corn and soy beans, have been made without arriving at definite conclusions.

It has been concluded from trials with wheat and oats that when seeded in drill rows 3 or 4 in. apart there is no increase in yield over seedings in 6- or 8-in. rows provided the same quantity of seed is used.

In selection work with wheat for the past three years average yields of the original and selected strains have been obtained as follows: Original Fulcaster 35.9 bu. per acre, selected 40.5 bu.; original Early Ripe 31.4 bu., selected 27.3 bu.; and original Poole 31.6 bu., selected 31.8 bu. Leading varieties of wheat in tests conducted at Columbia included Harvest King, with a yield of 23 bu. per acre, Fulcaster 8-y and Mediterranean 30 with 21.4 bu. each, and Fulcaster with 19.3 bu. At Maryville, Mediterranean, Jones Red Wave, Harvest King, and Fulcaster gave the highest yields, amounting to 42.1, 41.4, 37.2, and 34.4 bu. per acre, respectively. Dietz, Fultz, Harvest King, and Fulcaster, with respective acre yields of 26.2, 22.7, 20.8, and 20.5 bu., were highest at Warrensburg.

In tests of forage crops at Columbia Canada field peas alone and mixed with oats proved best for spring-sown forage; mixtures of Amber sorghum and cowpeas, and Kafir corn and sorghum for summer forage; and a mixture of rye and vetch and rye alone for fall sowing. Sudan grass is said to be giving satisfactory results in numerous tests throughout the State.

The seed testing laboratory, conducted in cooperation with the U. S. Department of Agriculture, received 1,723 samples of seed during the year.

[Report of field crops work in New Mexico, 1916-17] (*New Mexico Sta. Rpt. 1917*, pp. 28-30, 55-71, figs. 5).—This reports the results of experiments on the duty of water for alfalfa, irrigation, and cultural tests with potatoes, and miscellaneous crop experiments, in continuation of work previously noted (E. S. R., 37, p. 32).

Six cuttings of alfalfa were harvested during the season, with an average yield of 5.96 tons per acre and an average duty of water of 58.11 acre-inches for irrigations of 2, 3, 4, and 5 in. The highest yield per acre was obtained from the 5-in. irrigation, 6.67 tons, and the lowest from the 2-in. irrigation, 5.3 tons, with duty of water amounting to 61.49 and 42.19 acre-inches, respectively. Additional irrigation experiments with fallow plats and plats sown to alfalfa drilled in and planted in rows to study the relation of soil, water, and crop to irrigation have given results with respect to yield and duty of water comparable to those described above. The data are also said to indicate that 3 in. of water applied at each irrigation to the cropped plats penetrated to a depth of about 8 ft., while 5-in. applications penetrated to about 6 ft. On the fallow plats the water appeared to penetrate to a depth of 10 ft. or over. Root measurements were made, on plats receiving 2 and 5 in. of water, after 2 years' growth, and roots obtained averaging 42 and 57 in. in length, respectively.

Winter irrigations of 10 and 5 in. on potato plats receiving level, ridge, and Greeley cultivation resulted in an average germination of 96 and 87 plants per plat, respectively, as compared with 54 plants for plats receiving no winter irrigation. Winter and summer irrigated Greeley and level culture plats are described as giving satisfactory yields, while the nonirrigated winter or summer plats were very poor. The effect upon yield of potatoes of different methods of irrigation and cultivation and of manure are depicted graphically.

Corn receiving manure has produced an average yield of 46.6 bu. per acre for the two years 1915 and 1916, as compared with a yield of only 17.3 bu. for unmanured. Corn grown in plats irrigated before seeding produced a 3-year average yield for three different varieties of 37.3 bu. per acre and an average stand of 58 per cent, as compared with a yield of 41.2 bu. and a stand of 89.3 per cent for the same varieties grown on plats irrigated after seeding.

Tests of methods of Johnson grass eradication, of Sudan grass and Russian thistle suitability for forage, and of varieties of sugar beets and alfalfa are briefly noted.

In cotton variety tests, the three best varieties were Burnett with 1.47 bales of lint cotton per acre, Durango with 1.46 bales, and Allan Improved Triumph with 1.37 bales.

[Field crops work at the Canada stations and farms in 1915]. J. H. GUNDALE ET AL. (*Canada Expt. Farms Rpts. 1916*, pp. 108-115, 192-382, 643-647, 701, 702, 704, 705, 721, 722, 733-736, 765-769, 782, 783, 788, 789, 810-813, 817-822, 847-849, 861, 862, 872, 873, 880, 881, 902, 903, 911, 915, 916, 920-926, 932-954, 985, 994, 999-1093, 1129-1134, 1195-1300, 1331-1427, pls. 14).—A detailed report of variety, fertilizer, and cultural tests with cereal and forage crops, sugar beets, flax, hemp, potatoes, and tobacco in a continuation of similar work previously noted (*E. S. R.*, 36, p. 32). The results obtained are presented in tabular form and briefly discussed.

Variety and cultural tests with winter and spring wheat, oats, barley, field peas, flax for grain and fiber, winter and spring rye, emmer, spelt, buckwheat, vetch, corn for silage, root crops for forage, clover, alfalfa, and miscellaneous legumes and grasses for hay were conducted at the stations, substations, and farms in the Provinces of Ontario, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Manitoba, Saskatchewan, Alberta, and British Columbia. Rotation and fertilizer tests have been conducted in the same localities, and a rather extensive study made of the cost of production of various field crops. Date-of-planting tests and tests of different sized seed pieces have been made with potatoes; in addition to variety tests. Analyses of standard varieties of sugar beets grown at various centers are also presented.

Variety, cultural, and fertilizer tests with tobacco, and observations on seed-bed management and on harvesting and curing the crop conducted in the Provinces of Ontario and Quebec, are described as heretofore. Additional work dealing with a survey of tobacco soils in Canada, and the study of tobacco diseases and of selection and plant breeding work is outlined. The season of 1915 is described as having been absolutely adverse to tobacco growing, although a large increase in the production of bright tobacco in Ontario is reported, due to a more judicious selection of the soils. In fertilizer tests conducted at Farnham (Quebec) the yield with superphosphate was 1,583 lbs. of tobacco per arpent (0.84 acre), as compared with a yield of 1,481 lbs. from basic slag. A fertilizer formula including 250 lbs. of sulphate of ammonia, 150 lbs. of sulphate of potash, and 120 lbs. of superphosphate per arpent is recommended.

Tests in seed-bed management at Harrow (Ontario) indicated that the best results were obtained where fertilizers were applied before steaming the soil.

the root rot disease occurred to some extent in all beds, but is said to have been most prevalent where the greatest amount of fine mold from bush soil had been used, and during cool, unfavorable weather. The Turkish varieties and hybrids appeared to be least affected by the disease, while White Burley was specially susceptible.

**Report of the Mandalay Agricultural Station** (including Natiwagon substation) for the year 1915-16, E. THOMPSON and A. M. SAWYER (Dept. Agr. Burma, *Rpt. Mandalay Agr. Sta., 1915-16*, pp. 37).—Rather extensive fertilizer tests, cultural experiments, and hybridization work with rice at the Mandalay station are briefly reported, together with field tests of pigeon peas, wheat, and gram. Field tests with *Phaseolus lunatus* and *P. acutifolius* and selection tests with *P. lunatus*, *Cajanus indicus*, and *Pisum sativum* at the Natiwagon substation are also noted.

**Report of the Padu Agricultural Station** for the year 1915-16, E. THOMPSON (Dept. Agr. Burma, *Rpt. Padu Agr. Sta., 1915-16*, pp. 11).—This station was established in 1914 for the purpose of improving the varieties and cultural methods of wheat and gram in this region, to improve the short-staple cottons of the district, and to test new crops and rotations for the poor upland soils. Selection work with wheat and gram and field tests with wheat, gram, cotton, peanuts, sesame, and other native crops are briefly noted.

**Driage.**—The loss in weight of crops after harvesting, G. EVANS (*Agr. Jour. India, 12* (1917), No. 2, pp. 224-229).—The author claims that the results reported of crop experiments are often misleading, due to losses in weight of the crops after harvesting, so that they do not always represent the true marketable weight of the crops. He therefore reports a series of experiments with rice, peanuts, *Andropogon sorghum*, *Sesamum indicum*, *Olecr arcticum*, and wheat to determine their loss in weight through drying from time of harvest to time of thrashing.

Light, medium, late, and very late rice showed losses in weight of 11.75, 11.5, 9.5, and 6.5 per cent, respectively, in three days after harvesting. The Big Japanese variety of peanut showed a loss of 43 per cent in 8 days, 41.5 per cent of which occurred in the first 6 days. A smaller Japanese variety showed a loss of 46.5 per cent in 6 days. *A. sorghum* lost approximately 15 per cent in 3 days and more than 22 per cent in two months. The remaining crops showed losses of from 1 to 3 per cent, attributed to the fact that they were harvested dead ripe when the air was very dry and the temperature high, resulting in rapid evaporation. Further experiments are in progress in an effort to arrive at some factor which will allow suitable reductions for driage in the different staple crops.

**Grass land and plowed land**, R. G. STAPLETON (*Jour. Bd. Agr. [London]*, Sep. 17 (1917), pp. IV-5-39; *also in Nature [London]*, 99 (1917), No. 2488, p. 573).—In view of the necessity for increased production of home-grown food the author discusses in some detail the question of grass lands in their relation to food production in Great Britain. Dividing all grass land into (1) permanent grass (fields down to grass 20 years or more), (2) outrun grass composed of senile leys, or outrun permanent grass, and (3) rotations or temporary leys, he proposes improvement through top-dressing, renovating mixtures, altered methods of stocking, substituting pasture for meadow conditions or the reverse, eradication of weeds, and drainage, or through the breaking up of the turf and the conversion of poor grass into rotation land with temporary leys. It is suggested that the number of acres of grass land to be broken annually for a period of years be definitely decided upon in advance, the remaining grass land to be improved by the most appropriate of the methods noted above. The extensive use of basic slag, lime, and wild white clover is urged as fundamental

in stimulating production in districts of low average fertility, together with the selection of suitable mixtures of grasses and clovers for seeding the temporary leys. It is pointed out that the possibility of preparing grass land for rotation during the late spring and summer and in adverse winter weather allows considerable scope for the employment of motor tractors over a greatly extended period of the year aside from the plowing for fall wheat.

Grain production in Nevada, C. S. KNIGHT (*Nevada Sta. Bul. 89 (1917), pp. 3-14, figs. 16*).—Variety tests with wheat, barley, and oats and irrigation experiments with wheat are reported for the period of 1914-1916, inclusive, and cultural methods and field practices described as employed in the production of wheat, and in less detail of barley and oats in Nevada.

Of the wheat varieties tested, White Club, Bluestem, Marquis, Minnesota Fife, and White Australia, with average yields of 58.8, 55.7, 51.6, 48.5, and 44 bu. per acre, respectively, are deemed to be especially well adapted to growth under irrigation in the State.

The results of the irrigation experiments, embracing a comparison of 3- and 7-inch applications of water at the 5-leaf, boot, bloom, milk, and dough stages, respectively, and of the omission of one and two irrigations are held to indicate that in every case the 7-inch applications were superior to the 3-inch. The average yield of the 7-inch applications was 24.5 per cent greater than that for the 3-inch applications where one irrigation was omitted, 11.5 per cent greater where two irrigations were omitted, and 9.9 per cent where no irrigations were omitted. The highest average yield, 84.9 bu. per acre, was obtained from 7-inch applications where one irrigation was omitted in the 5-leaf stage. The lowest yields with both 3- and 7-inch applications were obtained when irrigations were omitted at either the boot or bloom stages. The most critical period in the irrigation of wheat is deemed to be between the boot and milk stages of development.

In tests of barley varieties New Zealand produced the highest average yield, 80 bu. per acre, for the two years 1915 and 1916, while Montana Blue Ribbon was highest for the 3-year period of 1914-1916, with 73 bu. per acre. The results of these tests are held to favor the 2-rowed varieties of barley.

Of the oat varieties tested Early Mountain, with an average yield of 81.75 bu. per acre for the 2 years of 1915 and 1916, was the only variety not seriously affected by shattering of the seed due to blasting of the panicles before the plants had matured. Practically 50 per cent of the grain shattered before harvest in most of the varieties tested.

Variety tests with wheat and barley were conducted during 1915 and 1916 in cooperation with the U. S. Department of Agriculture on the experiment farm at Fallon. Little Club, with an average yield of 48.9 bu. per acre, was the highest yielding wheat variety, and Coast, with an average yield of 39.6 bu. the highest yielding barley variety.

(Hybridization studies with spelt and wheat), H. M. GMELIN (*Culture. 29 (1917), No. 345, pp. 140-153, pls. 2; abs. in Internat. Inst. Agr. [Rome]. Internat. Rev. Sci. and Pract. Agr., 8 (1917), No. 9, pp. 1236-1239*).—The author reports and describes crosses of red beardless spelt with velvet chaff *Emet* wheat, and presents considerable tabulated data relative to the gametic composition of the F<sub>1</sub> generation.

Silage investigations, C. H. ECKLES and L. W. WINE (*Missouri Sta. Bul. 151 (1917), pp. 36, 37*).—Results of trials covering a period of four years are held to indicate that excellent silage may be made from any of several legumes provided the material contains approximately 40 per cent dry matter when put into the silo. Legumes cut for hay and containing about 25 per cent dry matter can be raised to 40 per cent by allowing the material to dry in the sun for

or five hours after cutting. The loss in dry matter in the silage from these sources is said to be about 10 per cent, while in material containing only 20 to 25 per cent dry matter the loss was more than 20 per cent.

Silage crops for western Washington. E. B. STOOKER (*Washington Sta., Wash. Sta. Mo. Bul.*, 5 (1918), No. 10, pp. 148-152).—The production and relative value of corn, clover and grass, winter wheat and spring vetch, and timothy and peas or vetch for silage in western Washington are briefly discussed.

Names of textile plant fibers. L. H. DEWEY (In *The Rubber Industry, London: Internat. Rubber and Allied Trades Ex.* [1917], pp. 341-350).—The author presents a check list of the principal textile plant fibers and fiber-producing plants, giving the names of the fibers, the common and botanical names of the plants, and the countries of production.

*Crotalaria usaramoensis* as a green manure. W. M. VAN HELTEN (*Dept. Publ. Nijv. en Handel [Dutch East Indies], Meded. Cultuurtuin*, No. 6 1917, pp. 3, pl. 1).—Observations of field tests with *C. usaramoensis* (formerly *C. maynisi*) are briefly noted.

The improvement of the jute crop by pure-line selection. R. S. FINLOW (*Agr. Jour. India*, 12 (1917), No. 2, pp. 283-290).—This is a progress report on the production of improved seed of pure lines of *Corchorus olitorius* and *C. plicatus*, with the view of improving the crop in Bengal.

New grasses for California.—I, *Phalaris stenoptera*, P. R. KENNEDY (*Univ. of Cal. Publ. Agr. Sci.*, 3 (1917), No. 1, pp. 24, pls. 8).—*P. stenoptera* is described and illustrated and its value as a perennial grass, capable of standing the winter temperatures and long, dry seasons in the central valleys of California is discussed.

The after-ripening of cane.—Chemical changes which take place after cutting. J. H. BARNES (*Agr. Jour. India*, 12 (1917), No. 2, pp. 200-215).—Experimental evidence is presented by the author indicating that the custom of cutting sugar cane before crushing, as practiced in the Gurdaspur District, India, is justified, as it tends to further ripening with a consequent increase in sucrose. It was also observed that the practice was attended with a danger of loss if the storing was continued for too long a period.

The length of time for which cane can be stored without suffering a decrease in sucrose and during which a natural increase may be expected is said to vary with the temperature of the air and the condition of the cane, decreasing with a rise of temperature. Excessive cold, including too great a change in temperature, may cause losses in sucrose, probably due to suspended cell activity and a consequent loss of control of the ordinary fermentation changes occurring in the cell.

The Gurdaspur practice of covering cut cane with damp trash to keep the cane stem alive maintains a uniform temperature with little loss of moisture and, according to the author, should result in a natural increase rather than a decrease in the sucrose content of the cane for a limited time, depending on the temperature and the condition of the cane. It is pointed out that moist heat will also induce the growth of molds, fungi, and bacteria, resulting in decay and fermentations and ultimate loss of sucrose.

Considerable tabulated data are presented giving the results of numerous analyses and calculations.

Behavior of sweet potatoes in the ground. H. HASSELEBERG (*U. S. Dept. Agr. Jour. Agr. Research*, 12 (1918), No. 1, pp. 9-17, fig. 1).—Experimental work suggested by the author's previous investigations (*E. S. R.*, 32, p. 633) is described in which the carbohydrate metabolism in Big Stem sweet potatoes grown in a sandy field at Bell Station, Md., was followed in order to determine

whether the quantitative relations between the starch content and sugar content remain constant throughout the latter part of the growing season and to throw some light on the determination of the best time of harvesting the crop. Samples of from 15 to 20 kg. of roots were collected each week from September 18 to November 27, inclusive, and moisture, starch, cane sugar, and reducing sugar determined in duplicate in 5 potatoes of each lot. The results of the analyses are presented in tabular form, illustrated graphically, and briefly discussed. The author also compares his observations with those made by Kett in South Carolina (E. S. R., 25, p. 534).

It is concluded "that the changes occurring in sweet potatoes in the ground during the latter part of the growing season proceed in a regular and orderly manner. During the later part of the period of growth the composition of the roots remains remarkably uniform, and presents no striking or irregular fluctuations. During this period the root is characterized by a high starch content and a low sugar content. The changes which occur later are associated with the death of the vines. Prominent among these changes is the accumulation of water in the roots as a result of the cessation of transpiration in consequence of the destruction of the leaves. With the termination of the flow of materials from the vines the carbohydrate transformations characteristic of sweet potatoes in storage are inaugurated. These changes consist in the transformation of starch into sugars. In point of time the decrease in starch and the increase in reducing sugar precede somewhat the increase in cane sugar. It appears, therefore, that reducing sugar is formed first as an intermediate step in the change from starch to cane sugar. The loss caused by respiration, which is considerable during the curing process and in storage, is apparently slight in sweet potatoes in the ground. Appreciable destruction of carbohydrates appears not to occur under these conditions until late in the season when the roots have been injured by frosts.

"The changes here described have a practical bearing on the question of maturation of sweet potatoes and on the choice of the time of harvest. . . . It is evident . . . that the choice of time of harvest is not a matter of maturity of the roots, but is governed by other factors. The potatoes may safely be kept in the ground until the leaves have been injured by frost. Of the changes which occur after the destruction of the leaves, the accumulation of water in the roots deserves foremost consideration. It can scarcely be doubted that this increased water content is detrimental to the successful storage of the roots, and causes them to be more subject to decay than roots of normal water content. . . . On this account it is of utmost importance that the harvesting of sweet potatoes be not long delayed after the leaves have been killed by frost. The other changes occurring in sweet potatoes in the ground are essentially the same as the changes occurring in storage. These changes are therefore in no way detrimental to the crop, since no appreciable loss of carbohydrates occurs until the roots have been so severely injured that they have lost their market value."

Tobacco culture in Egypt, V. MossÉNI (*Bul. Union Agr. Égypte*, 15 (1917: No. 119, pp. 33-73, figs. 2).—A detailed account of tobacco production under Egyptian conditions.

Structure of the pod and the seed of the Georgia velvet bean, *Stizolobium deeringianum*, C. V. PIPER and J. M. SHULL (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 13, pp. 673-676, pls. 2).—The microscopic structure of the pod and seed of *S. deeringianum* is described and illustrated. Since velvet bean meal gives promise of becoming an important commercial feed these structures are deemed important as a basis of identifying the meal either pure, adulterated, or in mixtures.

- In velvet bean meal the most abundant recognizable elements are: (1) The palisade cells of the testa; (2) the sclerenchyma cells of the pod; (3) the hairs of the pod; and (4) an occasional hourglass cell. Most of the fibers are broken, but with careful examination nearly all of the structures may be found. The most important elements to determine that the material is composed of velvet beans are the sclerenchyma cells and the hairs of the pods."

*Seed Reporter (U. S. Dept. Agr., Seed Rptr., 1 (1918), No. 3, pp. 8).*—This number contains the usual statistics and tabulated data on supplies, probable demands, movement, and market conditions of seed stocks, including seed sweet corn for canners, millet, velvet beans, seed potatoes for the South, onion sets (Chicago district), timothy, red and alsike clover, and alfalfa seed shipments, Sudan grass, broom corn, grain and forage sorghums in Kansas, Oklahoma, Texas, and Missouri, imports of forage plant seed permitted entry into the United States, and clover and timothy receipts and shipments for Chicago, Milwaukee, and Toledo markets.

Brief explanatory notes are given on the preliminary garden-seed survey made November 1, 1917, and previously noted (E. S. R., 38, p. 441). An appeal to the corn growers of the United States for cooperation with county, State, and national agencies with respect to needs and supplies of seed corn is made by C. P. Hartley. The development and production of pure Pima (Egyptian long staple) cotton seed by a cooperative cotton growers' association in the Salt River Valley, Ariz., is described by T. H. Kearney.

## HORTICULTURE.

[Progress report on horticultural investigations] (*Missouri Sta. Bul. 151 (1917), pp. 46-53, Aug. 5*).—In continuation of previous reports (E. S. R., 38, p. 743) concise statements are given of progress made along various lines of horticultural work during the year ended June 30, 1917.

Among the investigations in charge of J. C. Whitten, fruit nutrition studies were continued during the year with strawberries, peaches, and apples. The experimental work with strawberries was limited to applications of lime at the rate of 500 lbs. per acre. The lime was put on during the growing season of 1916. The limed plants developed better foliage and mildew seemed more prevalent on these plants, probably due to the heavier foliage. There was very little difference in yield between the limed and unlimed plots. Data are given on yield of varieties included in the experiment.

The peach crop was almost completely destroyed by the cold winter of 1916. It was shown, however, that the trees receiving nitrogen alone or in combination are more vigorous than trees not so treated. More trees are alive in the nitrogen plots than in the other plots.

A portion of the fertilizer work with apples was discontinued owing to the prevalence of blight, which was more serious on the fertilized trees than on unfertilized. Observations on the yield of apple trees grown from selected buds continued to show no superiority of trees from good parentage over trees from poor parentage. Examinations of buds in winter for forecasting probable bloom again demonstrated that with a little practice and observation one is able to predict very accurately the amount of bloom that a given branch of the tree will produce.

The work of breeding apples for late-blooming habit was continued. Seedlings were grown from previous crosses and a number of new crosses made. In the treatment of apple canker diseases the eradication of apple canker from the horticultural grounds by cleaning out and disinfecting the canker wounds has been highly successful.



A number of asparagus seedlings are being grown in the nursery as a result of intercrossing and selection experiments. The work has thus far shown that the selection of seedlings from intercrossed parents results in securing the large plants, whereas with seedlings of ordinary stock of some varieties only occasional large plants were secured. So far as can be judged a large number of the seedlings apparently inherit the succulence and desirable qualities of the parents from which they were selected.

Further observations made by C. C. Wiggins on fruit-bud development as influenced by treatment and previous crops bear out previous reports that individual spurs of the varieties under consideration will fruit two years in succession only in exceptional cases. Attempts are being made to determine the amount of stored plant food in the spurs by determining the amount of carbohydrates present. Determinations of reducing sugar, total sugar, and starch indicate that there is no great difference in the amount of these present in bearing and nonbearing spurs. The determinations were made between January and June, 1917, upon spurs of the previous year. Moisture determinations showed that the bearing parts have a slightly higher percentage of moisture than the nonbearing fruit spurs. The water movement from fruiting parts appears to affect the spurs as well as adjacent leaves. The cortex sap from bearing parts was found to be more concentrated than the sap from nonbearing parts. Freezing-point depression tests of sap from parts bearing more than one fruit indicate that there may be some correlation between the number of fruits and depression of the freezing point. Leaf sap and also spur sap from spurs bearing three apples was slightly more concentrated than sap from spurs bearing one apple. In general, the bearing spurs have a smaller number of leaves and the leaves are smaller in size than on similar nonbearing spurs. The total leaf surface of nonbearing spurs averages nearly 50 per cent greater than that of the fruiting spurs.

Further observations were made by J. C. Whitten and C. C. Wiggins on the relative value of fall and spring for planting fruit trees. Fall planting gave the best results, as in previous years. The past year's work emphasizes more fully that root growth does not begin until after the ground freezes on top and shows that late fall planted trees came through the winter in far better condition, making larger growth in the spring than those planted earlier in the fall.

In continuation of previous station studies on the rest period of horticultural plants (E. S. R., 35, p. 221) preliminary investigations were undertaken by W. H. Lawrence with the view of determining greater specific knowledge of the factors influencing the rest period of horticultural plants. An outline is given of the preliminary work undertaken, but no results are presented at this time.

In connection with cooperative spraying experiments conducted under the direction of W. H. Lawrence, numerous complaints have been received relative to the burning of the foliage and the russetting and burning of the fruit. A study was made of several of the combination sprays more commonly employed, with special reference to this trouble. The results indicate that lime-sulphur-arsenate of lead produced fruit of the best keeping quality, had a favorable action on the size, did not have an inhibitive action on the normal coloring of the fruit, produced the smallest percentage of injury known as calyx burn, had the least severe action in russetting the fruit, gave the best results in controlling curculio, and induced the least burning of the leaves and the smallest percentage of defoliation of the tree.

[Report of horticultural investigations] (*New Mexico Sta. Rpt. 1917*, pp. 43-51, 55, figs. 2).—Brief statements of progress made with various horticult-

and progress, including some data on variety and cultural tests of orchard and small fruits, nuts, and vegetables.

Satisfactory progress was made in the work of improving the native chili E. S. R., 33, p. 499). In 1916 an acre was planted to No. 2, one of the best varieties developed. The yield amounted to 10,065 lbs. of fresh red chili, or 100 lbs. after it was thoroughly dried and sacked.

Report from the division of horticulture for the year ended March 31, 1916, W. T. MASON ET AL. (*Canada Dept. Farms Expts. 1916*, pp. 611-642, 647-648, 704-705, 706-707, 708-709, 710-711, 712-713, 714-715, 716-717, 718-719, 720-721, 722-723, 724-725, 726-727, 728-729, 730-731, 732-733, 734-735, 736-737, 738-739, 740-741, 742-743, 744-745, 746-747, 748-749, 750-751, 752-753, 754-755, 756-757, 758-759, 760-761, 762-763, 764-765, 766-767, 768-769, 770-771, 772-773, 774-775, 776-777, 778-779, 780-781, 782-783, 784-785, 786-787, 788-789, 790-791, 792-793, 794-795, 796-797, 798-799, 800-801, 802-803, 804-805, 806-807, 808-809, 810-811, 812-813, 814-815, 816-817, 818-819, 820-821, 822-823, 824-825, 826-827, 828-829, 830-831, 832-833, 834-835, 836-837, 838-839, 840-841, 842-843, 844-845, 846-847, 848-849, 850-851, 852-853, 854-855, 856-857, 858-859, 860-861, 862-863, 864-865, 866-867, 868-869, 870-871, 872-873, 874-875, 876-877, 878-879, 880-881, 882-883, 884-885, 886-887, 888-889, 890-891, 892-893, 894-895, 896-897, 898-899, 900-901, 902-903, 904-905, 906-907, 908-909, 910-911, 912-913, 914-915, 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2932-2933, 2934-2935, 2936-2937, 2938-2939, 2940-2941, 2942-2943, 2944-294

trees and the grass cut and let lie; the grass cut and allowed to lie where it falls, no additional mulch given the trees; and the grass cut and raked up to form a mulch collar about the trees. Combinations of these systems of management are also being studied on certain plats. Portions of certain plats are also being fertilized to determine whether lack of any particular fertilizer should be taken into account in interpreting the effects of different systems of soil management. In addition to determination of soil temperatures and soil moisture, physical, chemical, and bacteriological studies are being conducted. The experiment is described in detail, and the results of the different systems of culture, both with reference to the tree and with reference to the soil, are presented in a series of tables and fully discussed.

Among the results thus far secured the authors found that there have been no wide variations in phenological behavior of trees under different systems of soil management, yet there does occur a marked slackening up of growth on grass plats during the dry periods in summer. Trees grown under a clean culture cover crop system or under a heavy mulch made 44.5 per cent greater average yearly gains in trunk girth than trees grown in grass with a light mulch or a mulch at all. There has been no significant difference between the three varieties in their response to soil management treatments. The Stayman Winesap made slightly greater trunk girth on all plats than either Grimes or Jonathan.

The authors point out that the effect of the various systems of soil management on the soil moisture as observed in this work can not be directly applied in the abstract to the humid region in general. The soil in the experimental orchard has a low organic content and high proportions of silt and clay, the making it one through which water percolates slowly and one which is easily puddled. In this soil, mulching, either by cultivation or by using a heavy supplemental mulch, maintained the percentage of soil moisture to more than twice that of grassland during the two June droughts of the five years. These soil moisture conditions are closely correlated with the girth increase made by the trees. A study of the precipitation data obtained indicates that the variation in growth due to seasonal moisture conditions has been quite as large as that due to cultural practices.

Data secured in the soil temperature studies do not support the opinion that rains are an important adjunct in warming the soil. The single factor of soil moisture does not appear to have had an influential bearing upon the temperatures existing under the different systems of soil management. The temperature range varies inversely with the amount of mulch covering the soil. As far as this experiment is concerned the rôle of soil temperature within the limits of ordinary cultural practices appears to be a neutral factor in tree growth.

Among the chemical changes induced in the orchard soil by cultural practices during the period 1910 to 1915 it appears that clean cultivation tends to deplete the soil of its organic matter, despite the fact that a cover crop is being turned under each year. Organic matter has slightly increased in the straw mulch plat. The sod plats as a whole have come nearer to holding their own in volatile matter, humus, and nitrogen than the clean culture-cover crop plats. There was no apparent correlation between the amount of volatile matter, humus, and nitrogen in the soil and tree growth.

In most cases more bacteria were present in the sod plats than in the clean culture-cover crop plats. Variations in the amount of mulch on the sod plats have some influence on bacterial numbers. There appears to be no correlation of tree growth and soil moisture with bacterial numbers. Ammonification varied with the season. Differences between plats are not consistent with

seasonal climatic variations, and it is impossible to say that any cultural practice has affected the ammonifying power of the soil.

"Tests show that nitrification varies with the season, but that a growing crop of grass or rye lowers the nitrate content of the soil; that the most nitrates are found under the clean culture-cover crop system, the straw mulch ranking second in amount of nitrates; that the girth gains of the trees are roughly proportional to the nitrate content of the soil; that there is no relation between the nitrifying power of the soil and either cultural practices or tree growth; however, the ratio between the nitrates present in the field and the nitrifying power of the soil does bear a relation to tree growth."

Varieties and culture of cane fruits in western Washington, J. L. STAHL (*Washington Sta., West. Wash. Sta. Mo. Bul.*, 5 (1918), No. 10, pp. 144-148).—Popular instructions are given for the culture of raspberries, blackberries, and loganberries, including descriptions of varieties adapted for culture in western Washington.

Shall I plant a garden this year? J. W. LLOYD (*Illinois Sta. Circ.* 200 (1918), pp. 4, figs. 2).—This circular discusses the importance of planning a home garden, gives a list of the station publications dealing with gardening, and presents tentative plans for a suburban garden and a farmer's garden.

Insecticides and fungicides, F. T. SHURT (*Canada Expt. Farms Rpts.* 1916, pp. 169-173).—Analyses are given of samples of lime-sulphur, lead arsenate, calcium arsenate, zinc arsenite, potassium cyanid, tobacco extracts, and a naphthalin preparation received for examination during the year.

## FORESTRY.

Forestry and the war, B. E. FERNOW (*Jour. Forestry*, 16 (1918), No. 2, pp. 149-154).—A discussion of the relations of the war to forests and forestry, with special reference to the development of future forest policies in America.

An inventory of Florida's forests and the outlook for the future, R. M. HARRIS (*Bien. Rpt. Dept. Agr. Fla.*, 14 (1915-16), pt. 2, pp. 194-213, figs. 12).—An inventory of Florida's forests with reference to their area and density; distribution and character; frequency of fire in different types; composition, including a list of the commonest species; rate of growth and consumption; and influences affecting the future of the forests.

Third biennial report of the State forester of the State of Colorado, W. J. MONKILL (*Bien. Rpt. State Forester Colo.*, 3 (1915-16), pp. 22, figs. 2).—A progress report on forest protection, investigation, and educational work, including a financial statement for the two-year period ended November 30, 1916. Recommendations relative to future activities are also included.

Results for four years are given on a fence post treating project being conducted in cooperation with the Forest Service of the U. S. Department of Agriculture. Posts of fire-killed alpine fir and lodgepole pine, and of Englemann spruce, cut green and seasoned 12 months, were treated in different ways, principally with water-gas tar creosote from the local gas plant in Fort Collins. The results to date indicate in general that the open-tank method of treatment is far superior to the brush method of treatment and has been highly satisfactory in preserving posts. Immersion in hot water-gas tar for 1 hour and allowing the posts to cool 1½ hours in the open tank gave as good results as immersing the posts for 2 hours in the hot water-gas tar and allowing them to cool for 20 hours in the open tank.

The present condition of plantings of some 51 species of trees on the Colorado Agriculture College farm made in the spring of 1905 is indicated, together with data on the present condition of plantings made at later dates with stock

secured from various parts of the United States. In basket-willow experiments that have been under way for several seasons the purple, American green, and Caspian varieties have been particularly successful. Data are also given on the present condition of a number of tree species planted in 1909 and 1910 in shelter-belt plantings at Akron, Washington County, with special reference to determining their adaptability to the windy plains region. The results from this experiment, as a whole, indicate that conifers will prove better than broad-leaf species in the nonirrigated region of eastern Colorado.

[Progress report on forestry investigations] (*Missouri Sta. Bul. 151 (1917)*, p. 45).—Investigations of the growth and culture of varieties of basket willow for Missouri are being conducted by E. C. Pegg. Observations on the willow holt to date show that the widest spacing yields the fewest rods and gives greatest weight per rod, and the narrowest spacing yields the greatest number of rods with least weight. Generally speaking, the number of rods is greatest from tip cuttings and lowest from butt cuttings.

A third examination was made of fence posts given various preservative treatments and set in November, 1913. "The most perishable woods are the sycamore, basswood, willow, persimmon, cottonwood, birch, dogwood, black oak, red oak, sugar maple, and ironwood. Charring the ends of posts previous to setting them seems to have been successful only in the case of the sycamore. In the case of black ash, redbud, and white elm it hastened the decay. Setting in gravel and with one brush coat of hot carbolineum is of little value in preserving perishable woods. Two coats of creosote lengthens the life of the posts. The open-tank method of treatment confined the fungus attacks to less than 7 per cent of the posts. No failures have yet occurred with posts treated in this manner."

Report of the committee on forestry of the Hawaiian Sugar Planters' Association for the year ended September 30, 1916, L. A. THURSTON ET AL. (*Hawaii Sugar Planters' Assoc., Rpt. Com. Forestry, 1916*, pp. 33).—This report contains data on tree-planting operations on sugar plantations in the Territory of Hawaii, the working plan adopted by the Board of Agriculture and Forestry for investigating the adaptability of different trees for specific purposes, and reports by plantation managers upon the state of forestry upon their several plantations.

A report upon the present status of forestry in Hawaii by C. S. Judd is also included. Two new forest reserves were created in 1916, bringing the total area of proclaimed forest reserves in the Territory up to 798,344 acres, of which 546,352 acres consist of Government land.

Relation of stimuli to the cone production of western hemlock, R. WATSON (*Jour. Forestry, 16 (1918), No. 2*, pp. 168-175).—Observations are given on the effect of various stimuli in promoting seed production in the western hemlock.

The author concludes in brief that "very little is as yet known regarding the factors which influence the seed production of trees. Botanists have shown that the vegetative and reproductive activity of plants may be controlled to a certain extent by controlling the factors which influence the growth of the plant. If the vegetative activities of thrifty western hemlock trees are suddenly checked by injuries, the tree usually is stimulated to reproductive activity. Factors which commonly stimulate the tree thus are injuries by fire and insects, mechanical abrasions, wind-throwing, decapitation, and girdling."

Growth and management of piñon in New Mexico, H. H. CHAPMAN and C. E. BEHRE (*Jour. Forestry, 16 (1918), No. 2*, pp. 215-217).—On the basis of growth data collected by the junior author on the Santa Fe National Forest, it is concluded in substance that the retention and management of piñon

pine counts) within National Forests as a source of cordwood and mining where is justified.

Guide book for the identification of woods used for ties and timbers, A. SCHLES (U. S. Dept. Agr., Forest Serv., 1917, pp. 79, pls. 31, figs. 79).—This guide book points out the differences which are of practical value in the identification of various species of native woods used for ties and timbers. It is intended primarily for inspectors, but since it includes most of our commercial species it is of value to others interested in the identification of woods. Keys for the identification of the wood, both with and without the aid of a hand lens, are included, together with an appendix on a method of distinguishing long leaf from short leaf and loblolly pine ties or timbers.

Valuation of damages to immature timber, W. N. SPARHAWK (*Jour. Forestry*, 16 (1918), No. 2, pp. 176-191).—A comparative discussion of various methods of valuing damage in immature stands of timber.

First-aid manual for field parties, H. W. BARKER (U. S. Dept. Agr., Forest Serv., 1917, pp. 98, figs. 47).—A first-aid manual similar to that issued by the American Red Cross, and prepared with special reference to its use by field parties of the Department.

### DISEASES OF PLANTS.

[Report of the department of] botany, G. M. REED (*Missouri Sta. Bul.* 151 (1917), pp. 36-53).—Brief accounts are given of investigations conducted by the author on the physiological relation of the powdery mildews to their hosts, forest-tree diseases, a systematic and physiological study of rusts, grain smut and its control, and watermelon diseases found in southeast Missouri. The last investigation was carried on by the author in conjunction with Helen Johann.

The study of the powdery mildews has been largely to determine the susceptibility of oats to powdery mildews. So far no variety of common species of oats has been found entirely resistant to mildew.

The forest-tree disease investigations have consisted largely of collections and studies of forms occurring on different species of trees. In addition a study has been begun of fungi which attack fence posts, observations being made on the durability of fence posts and on the efficiency of different materials used for their preservation.

The watermelon diseases reported upon are said to occur in southeast Missouri, where considerable damage is done to watermelons, cantaloupes, and cowpeas. Isolations of strains of *Fusarium* were made, and infection experiments gave positive results for many of them. It is stated that *F. trichothecoides*, which has never been known to cause watermelon wilt, may in some instances prevent the appearance of seedlings above the ground.

In the study of rusts inoculation experiments with the crown rust of oats were carried out with 49 varieties and species of *Avena*, practically all proving highly susceptible and only a few showing any evidence of resistance. In conjunction with this experiment oats were tested for mildew, and a striking parallelism was noted between the relation of oat varieties to crown rust and to mildew. Some additional data were obtained regarding the resistance of wheat varieties to the black stem rust and orange-leaf rust.

The grain-smut studies have been carried on to determine the relation of wheat smut (*Tilletia foetida*) to the date of planting, and in practically every instance the percentage of smut was higher on late planted wheat. Some investigations with the sorghum-kernel smut (*Sphacelotheca sorghi*) were carried on to determine the susceptibility of certain nonsaccharin sorghums. In-

oculation experiments were made with varieties of oats to determine the susceptibility to *Ustilago avenae* and *U. levis*, with the result that all varieties showed some degree of infection, the amount varying from 5 to 1 per cent in most cases. *Avena suda* was attacked to the extent of 98 per cent.

[Notes on plant diseases] (*New Mexico Sta. Rpt. 1917*, pp. 22, 23, 24-2 fig. 1).—Continued investigations are reported on a disease of chili pepper which an attempt was made to show the relation of the disease to soil and water factors, but with negative results. A species of *Fusarium* is reported to have been isolated from diseased plants, but only a small percentage of inoculations made with the organism produced typical signs of the disease.

A brief account is given of a study of root diseases of alfalfa and fruit trees and of a plant disease survey made in the State. In conjunction with the survey, the fungus *Dothichiza populea* is reported as occurring on young poplar trees.

Report from the division of botany, H. T. Gussow et al. (*Canada Exp. Farms Rpts. 1916*, pp. 1095-1150, pls. 11, fig. 1).—This report contains accounts of the work carried on under the destructive insect and pest act, investigations in plant pathology and economic botany, and progress reports on the work at the field laboratories at St. Catharines, Ont., Charlottetown, P. E. I. and Fredericton, N. B.

Considerable regulatory work is reported on potato diseases and white pine blister rust. On the blister rust, an account is given by W. A. McCubbin of the life history of the fungus, *Peridermium strobi*, particularly the overwintering of the fungus on the currant (*E. S. R.*, 37, p. 558.)

In the plant pathology section of the report, accounts are given of investigations on powdery scab, mosaic disease, blackleg, and late blight of potatoes, with descriptions of experiments for their control. Very successful results were obtained by spraying the potatoes with 8:4:40 Bordeaux mixture in New Brunswick under the direction of G. C. Cunningham and on Prince Edward Island by P. A. Murphy, these men being in charge of the field laboratories in those Provinces.

Notes are given on the effect of wet seasons on grain, especially on the occurrence of sooty ear of wheat due to *Glaesporium herbarum*, a glume spot of wheat caused by *Septoria glumarum*, and wheat scab due to *Gibberella zeae* *nitii*; also on bitter pit of apples, the author agreeing with McAlpine as to its cause, etc. (*E. S. R.*, 37, p. 455).

The investigations in economic botany reported upon consisted principally of studies of the fiber of flax and hemp and work on poisonous plants.

In the reports from the various field laboratories, W. A. McCubbin, of St. Catharines, gives brief accounts of injury to maple trees by squirrels followed by various fungi, the defoliation of sycamores by *Glaesporium necris quum*, cherry injuries due to frost and to wet soil, winterkilling of strawberry roots, ripe rot of fruits due to *Rhizopus nigricans*, heart rot of pear trees attributed to various polyporous fungi, mosaic disease of tomatoes, etc. P. A. Murphy, of the Prince Edward Island field laboratory, describes brief experiments for the control of club root of cabbages and turnips and of various potato diseases and gives an account of work in progress on the growing of seed potatoes in Nova Scotia for planting in Bermuda; and G. C. Cunningham of the New Brunswick laboratory, reports on the organization of the plant disease work in that Province and on beginning various activities in research and extension.

Annual report of the mycologist, W. J. Dowson (*Dept. Agr. Brit. East Africa Ann. Rpt. 1915-16*, pp. 52-56).—Besides brief mention of experiments in progress on coffee leaf disease, the selection of wheat varieties derived from

rusts made four years previously which have proved resistant to rust, and other matters, the author states that it has not been necessary to spray since in the botanic garden since 1914 for the coffee leaf disease (*Hemileia vastatrix*). This disease is easily brought under control by pruning and by one or two applications of any dilute fungicide, after which one spraying each year is sufficient if weeding and pruning are properly attended to. The quarter strength mixtures are not so effective against this fungus on coffee at lower altitudes (such as that at the Government Farm, Kibos). This is probably due to the greater warmth and moisture of the climate.

(Citrus (lime, lemon, and orange) trees showed marked improvement after being sprayed with Bordeaux mixture and lime-sulphur after the long rains of 1915. It is also recommended that the latter treatment be continued before the short rains in November.

[Plant diseases, Bombay Presidency], W. BURNS (*Ann. Rpt. Dept. Agr. Bombay, 1915-16, p. 69*).—The use of copper sulphate on sugar cane sets, in addition to being harmful to the plants, proves to be ineffective in preventing smut, which may be transmitted through aerial infection also. Red rot is exaggerated by an excess of water. The band disease of betel nut palms, said to be new here and to result in sterility, is under investigation, no fungus or insect having yet been identified as the cause of the trouble. A great increase is noted in the number of these trees sprayed for the koleroga disease of the betel nut palm.

[The effect of defoliation, of gases, and of fungi on plants], R. EWERT (*Ber. d. Lehraust. Obst u. Gartenbau Proskau, 1914, pp. 156-163; Landw. Jahrb., 48 (1915), Ergänzungsab.*).—Removal of blooms from an apple tree 45 years old having been followed the next spring by the production of blooms, the same treatment was tried on a tree 22 years old, with inconclusive results, neither this tree nor its control producing more than a few blooms. Some trees which lost their blooms through attacks of insects are said to have produced a good crop the next year.

Anthrax produced an effect on bush pea and *Polygonum sieboldi* similar to that given by coal-tar vapors.

Leaf cast of apple appeared this year to be independent of the presence of *Fusicladium*.

A study reported by Killian on the life history of *Venturia inaequalis* is briefly discussed, as is also one by Pletsch on *Trichoseptoria fructigena*, the cause of a rot in quinces and apples.

Normal parasitism and microbiose, V. GALIPPE (*Compt. Rend. Acad. Sci. [Paris], 165 (1917), No. 4, pp. 162-164*).—The author has given attention to the results of traumatism considered as favoring the development, particularly in fruits but also in animal organisms, of various kinds of the intracellular microscopic fungi and (rarely) yeasts which are normal to them. These have been called microzoms, and, it is claimed, may be caused in different ways (some of which are indicated) to enter upon a developmental phase at the expense of the cells. Microbiose is the name applied to the corresponding intracellular organisms in animals.

Normal parasitism has been studied as developed in apples by the application of pressure or of cold. Normal parasitism and microbiose appear to constitute a general feature of living cells, so that traumatism may develop, in addition, a quasiparasitism without any infection from without or in addition to the latter infection, which may really be a secondary feature of the trouble. This is regarded as having significance in case of wounds from projectiles, which, though absolutely aseptic, may determine an infection by the normal intracellular organisms.



**New Japanese fungi.**—Notes and translations, I. T. TANAKA (*Myologia*, 9 (1917), No. 3, pp. 167-172).—This is the first of a series of papers regarding newly discovered fungi or those which have been described only in the Japanese language. Species herein claimed to be new are *Vales* (*Basalis*) *paullownia* on Paulownia; *Marsonia carthami* on *Carthamus tinctorius*; *Mycospharella hordicola* on wheat and barley; *Scorias capitata*, *Pestalotia theae*, and *Zukalla theae* on *Thea sinensis*; and *Sclerotinia fagopyri* on *Fagopyrum esculentum*. A new combination proposed is *Ophiostoma* (*Ophiobolus*) *graminis*, now found on rice.

**Chemically induced crown galls.** E. F. SMITH (*Proc. Nat. Acad. Sci.*, 3 (1917), No. 4, pp. 312-314).—The author has continued studies, the main results of which have been previously noted (*El. S. R.*, 36, p. 747), which were intended to determine what by-products of the organism *Begotium tumefaciens* causally associated with crown gall in plants were the direct cause of the overgrowth. His experiments are said to show that this organism produces in very simple culture media aldehyde, ammonia, amines, alcohol, acetone, acetic acid, formic acid, and probably a little carbon dioxide, most of these substances being identical with those which are said to start growth in unfertilized eggs of the sea urchin. This action is thought to be purely physical; that is, due to the withdrawal of water from neighboring cells by increase of osmotic pressure.

Experiments with all of these products, so far as they have been carried out, have from young tissues a prompt response in the form of overgrowths, at first with their water dilutions and in later experiments with the vapors merely of these substances. These experiments were successfully made on several plants subject to crown gall, especially on *Ricinus*, cauliflower, and *Lycopersicon*. The tumors were small, being caused by only one application of the stimulus. It is thought that the continued application of these substances in very dilute form, comparable to the products of the parasite itself, would produce tumors essentially similar to those from crown gall or bacterial inoculations.

The tumors are either vascularized hyperplasias, mixed hypertrophy and hyperplasia, or simple hypertrophies, their cells being free from chlorophyll, closely compacted, and often 100 times as large as those from which they arose. In the alcohol tumors there was a great increase in the number of cells; that is, a true hyperplasia. Curious vascular displacements and duplications were also obtained, including, in one instance, an entire extra vascular cylinder in the pith of *Ricinus*.

Small overgrowths on cauliflower leaves have been recently obtained by the use of formaldehyde or formic acid.

**Cereal smuts.** T. H. SCHØYEN (*Meddel. Statsentomol.* [Norway], No. 3 (1917), pp. 4, fig. 1).—A brief discussion is given of the treatment of seed grain for protection against cereal smuts with hot water or with formalin.

**Truck crop diseases and how to control them.** R. E. VAUGHN (*Trans. 112 Hort. Soc., n. ser.*, 50 (1916), pp. 323-335).—This brief discussion includes onion smut, anthracnose, and rots; cabbage blackleg, black rot, clubroot, and yellows; and some account of protective measures.

**Experiments on the treatment of Rhizoctonia disease of asparagus.** B. T. P. BARKER and C. T. GIMINGHAM (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta.*, 1916, pp. 39, 40; *Jour. Bath and West and South. Counties Soc.*, 5, ser., 11 (1916-17), pp. 165-167).—In 1915 diseased asparagus plants from a plantation at Badsey were badly attacked and eventually killed by a soil fungus, *R. violacea asparagi* (*R. medicaginis*), causing a rot of roots and crowns. The soil treatments tested in 1916 showed the best results from 2 oz. bleaching powder per square yard, and from 1 oz. creosote,  $\frac{1}{2}$  oz. iron sulphate and 30 oz. lime coming next, and 2 oz. carbolic acid and 2 oz. naphthalene gr-

ing the least marked results. A striking feature of the plot treated with creosote was its relative freedom from weeds throughout the season.

Early and late blight of potatoes—cause and methods of control, J. WOOLMAN (Trans. *Ill. Hort. Soc.*, n. ser., 50 (1916), pp. 297-310).—This address deals with the causation and control of both early and late potato blights from the standpoint of the potato grower, also briefly with *Rhizoctonia* and other infestances affecting the potato industry.

*Odontia sacchari* and *O. saccharicola*, n. spp., on sugar cane, E. A. BURR (*Ann. Missouri Bot. Gard.*, 4 (1917), No. 3, pp. 233-236, figs. 2).—Two new species of *Odontia*, which have been collected by J. A. Stevenson, in Porto Rico, and which are to be considered by him in a separate paper, are technically described and have been named *O. sacchari* and *O. saccharicola*.

Mosaic disease of tobacco, G. H. CHAPMAN (*Massachusetts Sta. Bul.* 175 (1917), pp. 78-117, pls. 5).—The results are given of several years' investigation on the cause, occurrence, appearance, and methods of control of the well known mosaic disease of tobacco. These experiments were begun in 1907, and some of them have been repeated several times to confirm data regarding certain disputed points. More than usual attention seems to have been given the biochemical phases of the subject.

As a result of the author's experiments, it is believed that the disease is primarily induced by disturbance in the enzym activities and their relation to each other, due to abnormal metabolism and not to any parasite.

A series of experiments were conducted to test the claim of Lodewijks that colored light can diminish or cure mosaic disease (*E. S. R.*, 24, p. 648). The author found that the different colors have little or no effect on the causal agent of the disease; but, in the case of the blue, there is a strong depression of the macroscopic symptoms of the disease.

In connection with the control experiments, it was found that on fields where the mosaic disease is prevalent, the primary infection can usually be traced to the seed bed, and that many healthy seedlings are infected by workmen when setting the plants. It is estimated that about 80 per cent of the infection occurs in this manner. By careful attention to sterilization of seed beds and handling of plants at the time of transplanting, it is believed that a large percentage of infection may be avoided.

A black rot of apples, G. T. SPINKS (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta.*, 1916, pp. 24-26; *Jour. Bath and West and South. Counties Soc.*, 5. ser., 11 (1916-17), pp. 153-155).—Having followed up the studies previously reported (*M. S. R.*, 86, p. 750), the author describes the type of rot produced by *Monilia fructigena* in mature apples of different varieties, indicating some irregularities which were observed. The mycelium grows chiefly between the cells, but also occurs sometimes within. The kind of rot produced by *M. fructigena* can not yet be correlated with any chemical or physical character of the apple, but it is apparent that the factor which causes the black rot develops only as the apple approaches maturity.

As results of inoculation with *M. cinerea* were rather irregular, further experimentation is considered necessary.

Apple leaf scorch, B. T. P. BARKER and C. T. GIMMINGHAM (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta.*, 1916, pp. 41-45; *Jour. Bath and West and South. Counties Soc.*, 5. ser., 11 (1916-17), pp. 167-171).—A form of leaf scorch of apples, occurring usually during the month of June, with complete freedom of the leaves of the second growth, is described, with discussion of the possible bearings of the various factors. Though the problem is still regarded as unsolved, there is thought to be some ground for the belief that soil moisture and temperature are in some way concerned.

A spot disease of apples, G. T. SPINKS (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916, pp. 27, 28; Jour. Bath and West and South Counties Soc., 5. ser., 11 (1916-17), pp. 155-157*).—A study of the spot disease of apples, which was prevalent during the winters of 1913 and 1914, and again on some varieties during the winters of 1915 and 1916, has yielded some information regarding the spots, which look alike during the earlier stages, but may later show differences in growth rate, color, and firmness or softness. They may be caused by various fungi which enter through the so-called lenticel some time before a spot appears, so that the actual time of entry is not known. The spot grows rapidly as ripeness approaches. November and December apples, as a rule, can be affected only through points of injury.

A gummosis of apricot, V. PRALION (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 26 (1917), 1, No. 12, pp. 637-641*).—An apricot gummosis is described which is said to be due to a *Scierotinia*, probably *S. laxa*, highly specialized in regard to apricot. It appears first during the period of blooming, attacking the floral buds, branches, and trunk, and remaining in the mummified fruit which may hang on the trees.

Observations on pear blight in Illinois, F. L. STEVENS, W. A. RUTH, G. L. PELTIER, and J. R. MALLOCH (*Trans. Ill. Hort. Soc., n. ser., 50 (1916), pp. 216-227*).—It is stated that conditions in central and southern Illinois favor severe outbreaks of pear blight. It is thought that the use of trees propagated on the more resistant Japanese stock may prove to be of practical value for Illinois growers, the grafts being made preferably on the larger limbs to avoid body cankers.

Apple blight was especially severe in southern Illinois in 1914. A study was made in 1915 of the disease on 10-year-old pear trees and of control measures at Savoy, about 1,000 buds being treated with water suspensions of bacilli applied with a camel's-hair brush, half of these being covered immediately with wet cotton to prevent drying out. No significant difference in degree of infection developed between the treated and the untreated lots. Infections through rapidly growing shoots, especially water sprouts, were numerous during portions of the summer following wet weather in 1915, recent infections being seen as late as August 4. Insect agency appears to be important.

In the early spring of 1916 a few holdover cankers were observed on trunks and larger limbs, giving abundant infective material and spreading the disease throughout the orchard. Kieffer pear trees appeared to be more resistant than Garber, as regards pear blight. No exuding cankers were observed after the pears had bloomed.

Bordeaux mixture applied just as the first flowers were about to bloom controlled completely the blossom infection on Kieffer pear trees and did not interfere with the setting of the fruit. Lime-sulphur spraying, started later, was not quite so effective.

A root rot of black currants, G. T. SPINKS (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916, pp. 29, 30; Jour. Bath and West and South Counties Soc., 5. ser., 11 (1916-17), pp. 157, 158*).—Observations were made on a 4-year-old plantation of black currants, located on an old orchard site, in which several of the bushes appeared to be dead or dying in 1915 and 1916. A fungus appears to enter the plant near the crown or at the point where the main roots divide and then spread downward to the smaller roots. The fungus has not yet been identified, but is suspected to be of the *Armillaria* type. Young apple trees on similar areas are attacked apparently by the same fungus, which has not yet yielded any fructifications.

"Reversion" of black currants, A. H. LEECH (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916, pp. 31-34; Jour. Bath and West and South*

*Comptes Rend., A. ser., 11 (1916-17), pp. 158-162.*—This trouble is said to have caused extensive loss to the growers of black currants in recent years. It is briefly described according to the characteristics usually displayed. The presence of the bud mite is not considered fully adequate to explain the effects observed.

Grape downy mildew, M. GILARD (*Vie Agr. et Rurale*, 7 (1917), No. 18, pp. 317-319, fig. 1).—This is a general account of data collected by several persons from the study of grape downy mildew (*Plasmopara viticola*) and of measures for its control.

Sulphur mixtures for treating *Oidium*, L. RAVAZ (*Prog. Agr. et Vit.*, 34 (1917), No. 4, pp. 77-84).—The author, reporting results of tests of grape varieties, as suggested by the differences in the results obtained by some experimenters, states that the materials usually added (ashes, lime, etc.) have no other value than to dilute the sulphur. This latter may be used in pure form or with admixtures, according to such circumstances as violence of attack, susceptibility of the variety in question, and cost of materials.

Studies on the diseases of the mulberry, G. ARNAUD (*Min. Agr. [France], Ann. Serv. Epiphyties*, 2 (1914), pp. 25-30).—Continuing to report on mulberry diseases (*E. S. R.*, 33, p. 54; 33, p. 751), the author gives an account of the study of mulberry gummosis (*Bacterium mori*) in 1914, as regards the development of the infection, alterations in the leaves, and the incubation period in the branches.

Careful observation has failed to confirm the supposition that aphids (*Aphis crasmi*) are instrumental in the transmission of infection. Hail injury does not appear to be sufficient explanation for all cases. Uninjured leaves do not seem to become infected. The incubation period appears to be long and to depend largely upon weather conditions.

Visit to Upper Rewa to investigate leaf diseases of the banana, C. H. KNOWLES (*Dept. Agr. Fiji Pamphlet 24 (1916), pp. 5*).—Bananas in the areas visited appear to be affected by leaf-spotting fungi, of which *Cercospora musa* and another fungus, probably a *Dothideella*, are mentioned.

Walnut diseases, P. PARMENTIER (*Vie Agr. et Rurale*, 7 (1917), No. 22, pp. 33-396, figs. 6).—The author lists with brief discussion parasitic animals and plants and nonparasitic injurious influences affecting the walnut.

Dying of young pines in circles about ant hills, F. W. HAASIS (*Jour. Forestry*, 15 (1917), No. 6, pp. 763-771, figs. 5).—Having made a collection of data since 1915 on the dying of young pines around ant hills in the 1908 plantations at Portland, Conn., the author states that the phenomenon is associated usually, at not always, with ant hills, both *Formica exsectoides* and *F. fusca subsericea* being noted in this connection. The trouble, which occurs in both plantations and wild stands, is usually associated with fungus and scolytid infestations, 9 species of fungi having been isolated from the diseased areas. The trouble probably originates at a lentice. Negative results were sometimes obtained from bark inoculations. The ants are thought to be instrumental in the spread of the disease. The infection appears to be primary.

Summary of blister rust situation in Massachusetts, H. T. FERNALD (*Mass. Forestry Assoc. Bul.*, 119 (1916), pp. 23-25, fig. 1).—In the spring of 1915, the white pine blister rust was known in only a few localities in Essex County and the central and western portion of the State. In the fall of that year, the organism was found on currants and pines in Berkshire County. Federal and State scout work showed that *Ribes* was diseased in 205 towns of the State and pine of all ages in about 45 towns. Removal of *Ribes* on a large scale is noted.

White pine blister rust (*Rpt. Min. Lands, Forests and Mines, Ontario, 1911*, pp. 147-149, pl. 1).—A summary is given of the status of white pine blister rust as it now exists in Ontario. A large number of infections of white pine are reported to have been found in the Niagara Peninsula, especially in Peham, Thorold, and Grimsby townships, many being found on native pine. The disease appears to have become firmly established and presents a serious problem owing to the prevalence of both currants and white pine.

Pure cultures of wood-rotting fungi on artificial media, W. H. LONE and R. M. HANSCH (*U. S. Dept. Agr., Jour. Agr. Research, 12 (1918), No. 2, pp. 31-82*).—The authors describe a method by which it is claimed that various wood-rotting fungi can be differentiated from each other by their cultural characters alone when grown upon artificial media, also a method by which the fruiting bodies or sporophores of wood-rotting fungi can be produced from pure cultures on artificial media. It is claimed that when cultural characters of closely related but really distinct species are compared, marked and constant differences in the character of the mycelium will be found on certain corresponding agar in the series of cultures representing the two species, while if the fungi are really of the same species, no constant differences will occur.

Basing the conclusion on these facts, the authors state that unknown rots can be identified by making pure cultures of the causative organisms from diseased wood.

#### ECONOMIC ZOOLOGY—ENTOMOLOGY.

Birds of America, edited by T. G. PEARSON ET AL. (*New York: The University Society, Inc., 1917, vols. 1, pp. XVIII+272, pls. 40, figs. 213; 2, pp. XIV+211, pls. 37, figs. 197; 3, pp. XVIII+239, pls. 34, figs. 182*).—These volumes, which comprise 1 to 3 of the Nature Lovers Library, contain precise and fairly complete descriptions of the external physical appearance of about 1,000 species and subspecies of American birds, based for the most part on Ridgway's Birds of North and Middle America (E. S. R., 30, p. 851); popular characterizations, or life histories, of the species with especial regard for portraying their interesting and distinctive traits; and data on the actual usefulness of birds based on publications of the Bureau of Biological Survey of the U. S. Department of Agriculture. Under each species a technical description is given for the use of the more experienced observer, which includes common names, general description, color, nest and eggs, and distribution. This is followed by a popular account in large type intended particularly for the layman. The descriptions of birds not included in parts 1 to 7 of Ridgway's work were written by R. I. Brasher. The order in which the birds are arranged is that followed in the check-list of American Ornithologists' Union.

Volume 2 contains an article by E. H. Forbush on Out-Door Bird Study (pp. V-XIV) and volume 3 an article by W. W. Cooke on Bird Migration (pp. V-XVIII). Color keys to water birds, land birds, and to warblers; a glossary of technical terms; a bibliography; and an index to the three volumes are appended to volume 3.

Mammals of America, edited by H. E. ANTHONY ET AL. (*New York: The University Society, Inc., 1917, vol. 4, pp. XXII+335, pls. 6, figs. 224*).—This volume on American mammals is the fourth of the Nature Lovers Library. A paper on American Game Protection (pp. XV-XXII) by T. S. Palmer, of the Bureau of Biological Survey of the U. S. Department of Agriculture, is followed by technical descriptions of the species, under each of which is given (1) the animal's scientific name, (2) other names, (3) general description, (4) dental formula, (5) pelage, (6) measurements, (7) range, (8) food, (9) general

remarks, and (10) related species. A glossary of technical terms, a bibliography, and an index are included.

Gopheroides, F. T. SHUTT (*Canada Expt. Farms Rpts.* 1916, pp. 173, 174).—This is a report of analyses made of prepared gopher poisons that were found on the market in northwestern Canada. Inquiries made among those who have had experience in gopher poisoning indicate that the proprietary preparations are being discarded in favor of home-prepared baits, using strychnine or strychnine sulphate as the poison.

The wild rats of the Southern States as carriers of *Spirochæta icterohæmorrhagica*, J. W. JOELING and A. A. EGGSTEIN (*Jour. Amer. Med. Assoc.*, 62 (1917), No. 21, p. 1787).—Ten per cent of more than 100 rats collected in Nashville, Tenn., harbored *S. icterohæmorrhagica*. The rats were obtained from different parts of the city, and so far as could be determined the various localities gave about the same proportion of infected animals. An account of the occurrence of this spirochete in wild rats by Noguchi has been previously noted (*E. S. R.*, 37, p. 577).

[Report on entomological work] (*Kansas Sta. Rpt.* 1916, pp. 15, 16, 18, 19).—Brief statements are made of the status of investigations of the Hessian fly, corn ear-worm, fruit insects, grasshoppers, chinch bug egg parasites (in which the average percentage of parasitism during the year was 12.0), climate and injurious insects, etc.

Entomology (*Missouri Sta. Bul.* 151 (1917), pp. 33, 39).—Brief statements of the work of the year are made by L. Haseman and K. G. Sullivan of an investigation of the insects injurious to nursery stock in the State; by A. H. Hollinger on the scale insects of Missouri; and by L. Haseman on injurious insect pests of melon and related crops, on the causes of the periodical outbreaks of insect pests, and on the annual cycle of the Hessian fly in Missouri and its control.

In control work with the San José scale on nursery stock, hydrocyanic acid gas destroyed from 97 to 98 per cent of living scale and a miscible oil dip destroyed from 99 to 100 per cent. It is stated that 13 new species of scale insects have been found in the State during the year and 9 additional genera recorded.

[Entomological work] (*New Mexico Sta. Rpt.* 1917, pp. 23, 24, 28, 27, 51-55, fig. 1).—Brief statements are made of the work of the year with the San José scale, harlequin cabbage bug, and other injurious insects, including a leaf miner (*Agromyza costellata*) which did considerable damage to early potatoes and beans in the spring of 1917. Data relating to life history studies of the codling moth are briefly considered and a spraying calendar for its control on apples and pears for 1917 is presented.

[Economic insects in Yakima County, Wash.] (*Ann. Rpt. Hort. Dept. Yakima County, Wash.*, 1916, pp. 6-9, 19-25, 38-72, figs. 2).—The accounts here given by De Sellem relate to the occurrence of and control work with the more important pests of horticultural crops during the year (pp. 6-9: codling moth investigations and determination of spray dates (pp. 19-22); summary of data on codling moth control for the season of 1916 (pp. 23-25); codling moth investigations (pp. 38-52); codling moth breeding work, season of 1916 (pp. 53-61); and nicotine sulphate for codling moth control (pp. 62-72). The Colorado potato beetle made its appearance in the Yakima Valley, near Sunnyside, in 1916 for the first time and its eradication was attempted.

"The work during 1915 and 1916 indicates that nicotine sulphate acts as a material check to the work of the codling moth. At the present prices of nicotine it would not be advisable to substitute nicotine sulphate for arsenate of lead

in codling moth control alone, but where aphids and sucking insects are to be controlled the omission of lead will result in a considerable saving."

In the experiments here reported, "when nicotine sulphate and arsenate of lead have been used side by side the former has proved as efficient as the lead in codling moth control and has kept the trees free from all sucking insects. Trees sprayed with nicotine sulphate showed much higher percentages of extra fancy and fancy fruit than the trees sprayed with lead. The fruit was more highly colored. Observations during the seasons of 1915 and 1916 indicate that the nicotine acts as a material check to the spread of San José scale. In the nicotine sprays the addition of soap is advisable. It does not seem necessary to use nicotine stronger than 1:800 for codling moth and 1:1,024 has given nearly as good results."

[Economic insects in France] (*Bul. Soc. Path. Veg. France*, 4 (1917), No. 1, pp. 8-18, 41, 45-47).—Among the papers here presented relating to economic entomology are Notes on a Bacterial Disease of the Vine Pyralid, by G. Daumazon (pp. 8-10); Carabids Injurious to the Strawberry Plant, by P. Leane (pp. 11-15); Concerning a Claim of Priority Relating to *Asterolecanium variolosum* (*A. quercicola*), by G. Arnaud (pp. 16-18); on *Cynips villoles*, by P. Marchal (p. 41), and The Anthonomes, by A. L. Clément (pp. 45-47).

War on greenhouse pests, H. A. Gossard (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 12, pp. 394-396).—This is brief popular summary of information on plant lice and white fly and the manner in which they may be controlled.

Potato plant lice and their control, W. S. REAGAN (*Massachusetts Sta. Bul.* 177 (1917), pp. 135-146).—This is a report of investigations made during the course of the serious outbreak of the potato plant louse (*Macrostaphus solanifolia*) in Massachusetts in 1917. Their injury to potato plants became evident during the second week in July and rapidly increased in severity until the latter part of the month and early August, when no progressive injury could be noticed and an examination of previously badly infested fields showed them to be present only in very small numbers or in numbers insufficient to cause further material injury during the season. Thus it appears that there was a period of from three to four weeks when the plant lice were dangerously prevalent upon potato plants, and the author's observations on this point were substantiated by reports from other sections and the past history of its outbreaks. During the outbreak the potato fields showed injury varying from slight to complete destruction of the plants, some patches being completely free from infestation while others near by were badly injured or destroyed before insecticides could be applied. Migration to the winter hosts in Massachusetts appears to take place to some extent during the latter part of July, but mainly during August.

Spraying experiments were conducted with a number of contact insecticides, several of which (blackleaf 40, 1:800; Nicofume liquid, 1:750, with soap; fish-oil soap, 1:6) destroyed from 98 to 100 per cent of the plant lice without injuring the plants. The results obtained have led the author to conclude that the pest can be readily controlled by the use of blackleaf 40 or similar nicotine preparation at the rate of 1 part to 800 parts of water, with the addition of common laundry soap, dissolved in boiling water, at the rate of 2 lbs. to 50 gal. of the diluted blackleaf 40 solution. One application properly applied to the underside of the foliage when the infestation is severe enough to cause evident wilting of the leaves can in most cases be made economically and to advantage. Fish-oil or whale-oil soap at the rate of 1 lb. to 6 gal. of water is about equally as effective. It is pointed out that blackleaf 40 can be combined safely with Pyrox, Bordo-lead, Bordeaux mixture, or arsenate of lead, but that when these are added soap should be omitted. Kerosene emulsion is not highly effective against potato plant lice and the labor involved in preparing it is also against

its use. Tests of miscible or soluble oils seem to indicate that these materials are dangerous to use upon potato foliage. Lime-sulphur is ineffective, even at double the ordinary strength used upon foliage.

The advisability of applying treatment in the control of this pest depends upon the severity of the infestation, its seasonal importance, accessibility, available apparatus, etc. If injury to the plants has not been severe enough to kill portions of the tops of the plants to an evident extent before the first of August, it is probable that the injury likely to be done will not exceed the cost of applying treatment. When severe injury is noticeable before the first of August, a thorough treatment should be made at once. "The destruction by burning of potato vines after harvest, together with all weeds and other refuse about gardens and potato fields, unless such material is composted; the burning over of grassy and weedy fields in the vicinity of potato patches in the late fall or early spring; and late fall plowing of gardens are methods of clean culture which may materially reduce future infestation. Injury by potato lice renders the plants more susceptible to 'blight' and should emphasize the need for frequent sprays with Bordeaux mixture." In order to be effective the spraying outfit should include an extension rod with an underspray nozzle set at a right angle to the rod, in order that the underside of the leaves may be readily reached by the spray.

Brief mention is made of natural agents of control.

A report of investigations conducted in Ohio by Houser during 1917 has been previously noted (E. S. R., 38, p. 462).

The eye-spotted bud-moth (*Tmetocera ocellana*), E. M. Dufourx (*Ann. Rpt. Quebec Soc. Protec. Plants (etc.)*, 9 (1916-17), pp. 118-137, figs. 17).—Studies of the biology of the eye-spotted bud-moth and means for its control, made during the seasons of 1914, 1915, and 1916 in the Province of Quebec, chiefly on the island of Montreal, are reported.

The apple, pear, plum, cherry, quince, peach, blackberry, and laurel oak are recorded as food plants of this species in America. The author has taken it in Quebec on all these except quince, peach, blackberry, and laurel oak, and in addition on *Crataegus* and an ornamental flowering crab. A marked preference is shown for the apple.

There is but one brood each year, but the larvæ live throughout a portion of two seasons, and the injury done by the young larvæ in the summer and fall differs from that done by the older larvæ in the following spring. The latter part of April or early May the caterpillars become active and injure the leaf buds, flower buds, leaves, setting fruit, and sometimes the young twigs. In one orchard in which the infestation was comparatively light, 18 per cent of the flowers were destroyed. In Nova Scotia injury to the extent of 50.53 per cent of the blossoms is recorded, and in unsprayed orchards in Quebec the author found evidence of injury to more than 50 per cent of the fruit buds.

Pupation on the twig commences the first week in June, and 11 or 12 days pass before the adults emerge. The young caterpillar, which hatches out at the end of June or in July, immediately begins feeding on the underside of the leaf, where it makes tiny excavations in the tissue. The injury caused by its skeletonizing the leaves in summer may be more or less negligible, but more important direct injury is caused when the insect attaches a leaf to a fruit, feeding between the two and injuring the surface of the fruit. Usually in Quebec the first adults begin to appear about June 20, their emergence continuing for about 4 weeks. Mating may take place and oviposition begin as early as 24 hours after emergence, always at night and on the lower surface of the leaf, and continues for a period of several days. The eggs generally hatch in 8 or 9 days, but in one instance slightly less than 6 days was required.



The first 4 larval instars, of which there are thought to be 7, were observed to require 5, 6, 6 to 8, and 12 days, respectively. The winter is passed as a half-grown caterpillar, the majority hibernating after the third molt, though some have been found to hibernate in the fifth, some in the third, and a very few in the second, instars. This often takes place just beneath the leaf buds, but may occur in any well-protected rough or angular spot on the twigs and smaller branches.

Three hymenopterous parasites have been obtained from the bud moth in Quebec, namely, *Pimpla (Ictoplectes) conquistator*, (*Microgaster*) *Bassus curvicauda*, and *Pentarthron minutum*. Spraying experiments with lime-sulphur to which lead arsenate was added at the rate of 5 lbs. paste to 100 gal. was found to be most effective when employed as soon as the leaves expanded, and next in effectiveness when applied just before the petals spread.

The pecan leaf case-bearer, J. B. GILL (*U. S. Dept. Agr. Bul. 571 (1917), pp. 28, pls. 3*).—This is a report of investigations at a field station at Monticello, Fla., of *Acrobasis nebulella*, one of the principal insect pests with which the pecan grower has to contend. A brief account of the pest has been given by the author in a publication on pecan insects previously noted (*E. S. R.*, 22, p. 157), as has studies of the pest by Herrick at the Texas Experiment Station reported in 1909 (*E. S. R.*, 22, p. 461).

The species was first described by Riley in 1872 from a single specimen reared from wild crab (*Crataegus* sp.). It is a native insect that is distributed more or less over the same territory as the hickories which form its preferred hosts, but the author has found it very difficult to collect the larvæ on species other than the pecan, even in sections where it ranks as a pest in pecan orchards. There is said to be an apparent varietal resistance of the pecan to its attack, some being badly infested while others are slightly so; in general, pecan trees with very small leaves seem less likely to be heavily infested by it.

The most serious damage to pecans occurs during the early spring, when the larvæ feed voraciously upon the unfolding buds and leaves. Just as the buds are bursting, the overwintering larvæ gnaw their way out of their hibernacula or winter cases packed around the buds, and migrate immediately to the tips of the swelling buds, upon which they commence to feed. Some larvæ have been observed to eat directly through the side of the buds instead of at the tip as is usually the case. The larvæ, when in sufficient numbers, are capable of eating the green foliage as rapidly as it appears, and it is not unusual for the trees to remain defoliated for a considerable length of time. On such trees the buds turn brown as a result of the feeding of the larvæ and a block of badly infested trees takes on the appearance of blight by fire. When the infestation is less severe the larvæ web and tie the tender leaves together into masses, which soon become unsightly due to the wilting of the leaves and the presence of particles of excrement and larval cases with which they are united.

Biological studies at Monticello during 1913, 1914, and 1915 in an open-air insectary are reported upon, much of the data being presented in tabular form. The adults, which may emerge from early May to early August, live from 2 to 10 days, with an average of 4.8 days, during which time as many as 182 eggs may be deposited. From 6 to 9 days are required for the incubation of the eggs, which may hatch from the middle of May to the first days in August. The young larvæ feed sparingly upon the foliage throughout the summer and early fall for a period of nearly 3 months or even longer in some instances, during which time they hardly attain a length greater than 0.06 in. During the latter part of September they begin to seek hibernating quarters around the buds, where they construct small, compactly woven, oval hibernacula and

by the middle of October practically all larvae will have left the foliage and may be found snugly protected in the hibernacula. They remain in hibernation until the latter part of March or the first days of April, when they emerge and attack the unfolding leaves. The larvae reach full maturity from about April 20 to the latter part of June, but the majority pupated between May 10 and June 10 in 1913 and about 10 days later in 1914 and 1915.

Among the parasites reared from the pupa of this case-bearer are *Itopectis conquisitor*, *Triclistus apicalis*, *Calliephialtes grapholithæ*, and *Pristomerus* sp. of the Ichneumonidae; *Macrocentrus delicatus*, *Meteorus* sp., *Habrobracon variabilis*, and *Oryctes* sp. of the Braconidae; *Secodella acrobasis* and *Cerampachyus* sp. of the Chalcidoidea; and *Leskiomima tenera* and *Esoriata* sp. near *spate* of the Tachinidae. *Spilochalcis vittata* has also been reported from this host and *Trichogramma minutum* was on one occasion reared from its eggs. The small chalcidoid *S. acrobasis*, which was reared in great abundance from the overwintering larvae, is the most effective of the parasites.

Experimental control work which extended over a period of three years is reported in detail. The work shows conclusively that no matter how badly an orchard may be infested, the pest can be controlled by a single application of arsenical solution combined with lime, if made during the latter part of the summer. The best results are obtained from the use of 1 lb. of powdered or 2 lbs. of paste arsenate of lead and 8 lbs. of freshly slaked lime to each 50 gal. of water. It is pointed out that arsenate of lead should not be used under any circumstances without the addition of lime as loss from injury to the foliage and nuts is likely to follow. Spraying may be done with equal effectiveness any time between the first of August and the middle of September, which is after the eggs have hatched.

An annotated list of 19 references to the literature cited is appended.

An outline of the life history of the clothes moth, *Tineola biselliella*, R. C. BENEDICT (*Science*, n. ser., 46 (1917), No. 1193, pp. 464-468).—The author's investigations of clothes moths, conducted with a view to solving the problem of moth proofing ordinary woolen fabrics, have led to the conclusion that, in the vicinity of New York City at least, the case-making clothes moth (*Tineola pellionella*) is of comparatively rare occurrence and that the extensive damage which is done in connection with the fur and woolen trades is due almost entirely to the yellow clothes moth (*T. biselliella*). Both the black and buffalo carpet beetles were found invariably in each supply of moth material examined, but in comparatively small numbers. A much larger unidentified beetle occurred in great numbers in the supply of blown hat fur and rabbit skins which had their source in Australia.

Egg laying began within 24 hours after mating and from 30 to 160 eggs were deposited, the usual number being between 40 and 50. At the completion of oviposition, which might be in one day or as long as three weeks, the female dies. The eggs are carefully placed among the threads of the cloth and fastened by some gummy material so that they do not readily shake off. Hatching begins in 7 days and the larvae commence to feed immediately. They take the color of the cloth fed upon, the dyes passing through the alimentary canal apparently unchanged. When a larva wished to change its feeding place it either continued its gallery, sometimes for several inches, or left it entirely and built another. The larval stage is completed in a minimum period of 10 weeks while the cocoon stage lasts at the shortest two weeks.

Control experiments which were directed toward the discovery of a poison that would destroy the larvae through their food and which would not be harmful to human beings have given negative results.

The biological method of control for *Oeceticus platensis*, P. C. MASON (An. Soc. Rural Argentina, 51 (1917), No. 5, pp. 573-578, figs. 8).—A report upon the efficiency of several hymenopterous parasites in the control of this lepidopteran.

The malaria parasite in the mosquito.—The effects of low temperature and other factors on its development, M. B. MITZMAIN (Pub. Health Rpts. [U. S.] 32 (1917), No. 35, pp. 1400-1413).—"In the work presented here it is indicated that development of the exogenous elements in the mosquito is restricted or prevented during an intermittent low temperature even when temperatures favorable to parasite development are present in the early stages and subsequently. The presence of even great numbers of oocysts in various stages does not give assurance of subsequent maturity and infectivity. Of the 18 infected anophelines kept at low temperature only one appeared to give rise to mature parasites, while the one control specimen of *Anopheles quadrimaculatus* retained at room temperature reached normal maturity relative to sporozoite development. *Plasmodium falciparum* was the species of parasite used. The oocyst stage was maintained up to 59 days in the mosquitoes employed in these experiments."

Reference is made to the work by Kling, previously noted (E. S. R., 36, p. 558).

The Mediterranean fruit fly in Hawaii, E. A. BACK and C. E. PEMBERTON (U. S. Dept. Agr. Bul. 536 (1918), pp. 118, pls. 21, figs. 24).—This is a summary of the present status of the knowledge of *Ceratitis capitata*, based upon a review of the literature and extensive investigations conducted by the authors, much of which data is presented in tabular form. The subject is considered under the headings of origin, distribution, source of Hawaiian infestation, conditions favorable to establishment in the Hawaiian Islands, economic importance, injury, methods of spread, host fruits, life history and description, seasonal history, natural control, and artificial control. Some of the data included have been previously noted from other sources (E. S. R., 37, p. 565).

It is concluded that with the pest well established in Bermuda and the Hawaiian Islands it will only be a matter of time before it will be inadvertently introduced into and become established in California and the Southern States. It is pointed out that this fruit fly has been reared in Honolulu from 72 species of host fruits, including the peach, plum, pear, guava, mango, orange, lemon, grapefruit, banana, etc., and that no edible fruit in Hawaii, except the pineapple, escapes its attack although the banana is never infested unless overripe or injured. While a single generation may require as few as 17 days during the warmest weather, there are usually 15 to 18 generations a year at Honolulu and 10 to 12 generations in areas where the winter mean temperature drops to 63° F.

As regards control measures, it is concluded that at the present time the only hope of relief lies in the establishment of parasites, six of which have been introduced during the past three years and have already become well established. While they have more than repaid the Territory of Hawaii for the cost of their introduction by bringing about an improved condition in the coffee-growing industry, it is doubtful whether they will effect a sufficient decrease in the proportion of infested host fruits to be considered efficient factors in control, since adult flies maturing in thick-meated fruits, or in fruits protecting larvae by other means from attack by parasites, will neutralize the effective work of parasites attacking larvae in thin-skinned and thin-pulped fruits. Accumulated data indicate that the fruit fly will not become a serious pest in a climate where the mean temperature is below 50° F. during periods covering three months of the year. Freezing temperatures can be withstood

successfully only for short periods and little if any development takes place.

While Hawaiian conditions are unfavorable to the use of poison sprays, the authors' work has convinced them that such sprays could be employed successfully in combating this pest in commercial orchards of California and of the western States should they become infested. Attention is called to the use that can be made of commercial cold storage, the data presented indicating for the first time the duration of time required for various temperature ranges to kill the stages of the fruit fly within stored fruits. From these records it is reasonable to conclude that the certification of properly refrigerated fruit is practicable.

Considerable attention is given to parasites of the fruit fly, the history, description, and biology of *Tetrastichus giffardianus*, *Opius humilis*, *Diachasma tryoni*, and *D. fullawayi* being reported upon, and a discussion included of methods of rearing the parasites, struggle for supremacy among them, etc.

Fruit fly parasitism in Hawaii during 1916, C. E. PEMBERTON and H. F. HILLARD (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 2, pp. 103-108).—The data here presented supplement the parasitism studies considered at length in the report above noted and an earlier paper covering the year 1915 (*E. S. It.*, 3, p. 760). The paper includes tabular data on the extent of infestation of fruit by larvae of *Ceratitis capitata* in Hawaii during 1916, percentage of larval parasitism of *C. capitata* in Hawaii in 1916 and 1917, and total parasitism by months of all larvae of *C. capitata* collected in Hawaii during 1916.

The total percentage varied from 0.98 per cent in January to 45.2 per cent in September. The percentage of parasitism by *Diachasma tryoni* fell in the winter and spring to as low as 0.2 (March) and rose in the summer and fall to as high as 34 (September). "The parasite *Opius humilis*, more hardy and prolific than any of the other introduced species, has been overshadowed by the other species, particularly by *D. tryoni*, and has had its seasonal rise and fall directly the reverse and entirely dependent upon the rise and fall of this species of *Diachasma*. The slight seasonal changes have little visible effect upon the activities of *O. humilis*, however, for in the winter and spring, with the decrease in abundance of *D. tryoni*, it rapidly ascends and becomes the most effective check upon the fruit fly."

A comparison of data secured during the years 1914, 1915, and 1916 indicates that the parasites now present in the Territory have reached their maximum degree of development and can hardly be expected to attain a greater control of the fruit fly than that evidenced in 1916.

A new genus of Anthomyiidae, J. R. MALLOCH (*Bul. Brooklyn Ent. Soc.*, 12 (1917), No. 5, pp. 113-115).—The genus *Emmesomyia* is erected for two new species.

A study of the factors which govern mating in the honeybee, G. D. SHAFER (*Michigan Sta. Tech. Bul.* 34 (1917), pp. 5-19, pls. 3, figs. 2).—This brief report of investigations conducted during 1916 deals with the structural characters of the reproductive organs of both the queen and drone; position assumed by the queen and drone in relation to the mating flight; attempts to control either mating or fertilization of the queen honeybee; classification of certain recorded attempts to control mating, giving instances of mating during confinement in one way or another and instances of artificial fertilization by hand; and attempts at controlling mating carried out under this investigation.

Report from the division of bees for the fiscal year ended March 31, 1916, F. W. L. SLADEN ET AL. (*Canada Expt. Farms Rpts.* 1916, pp. 1151-1194, pls. 4).—The work of the year at the branch stations and the Central Experimental

Farm is first reported upon by the apiarist (pp. 1151-1153), followed by reports by the superintendents on bee work at the experimental farms (pp. 1153-1154).

A table summarizing the production of bees at 14 Dominion experimental farms in 1915 is included.

Beekeeping for the fruit grower and small rancher or amateur, G. A. COLEMAN (*California Sta. Circ. 185 (1917), pp. 11, figs. 8*).—A popular summary of information on beekeeping.

Results of cooperative experiments in apiculture, M. PERRY (*Ann. Ent. Ontario Agr. and Expt. Union, 38 (1916), pp. 33-40, fig. 1*).—A brief report of the results of cooperative work in Ontario.

The North American wasps of the subgenus *Pemphredon*, S. A. ROWEN (*Bul. Brooklyn Ent. Soc., 12 (1917), No. 5, pp. 97-102*).—A key is given to the nearctic species of *Pemphredon*, and descriptions of four new species and notes on several others.

The Cattleya fly, J. B. MOORE (*New Jersey Sta. Bul. 308 (1916), pp. 3-12, pls. 2*).—The hymenopteran *Isosoma orchidearum*, known as the Cattleya fly, which was imported with orchids prior to 1888, is now the most serious enemy of certain species of Cattleya. At first considered to be of little importance, the infestations have increased to such an extent that many growers have been forced out of business. Its injury is caused by the larvæ which burrow out the interior of the young buds or young pseudo-bulbs and weaken the growth to such an extent that very poor blooms or no blooms at all are produced. *I. moesta* and *I. gaskelliana* have very few injuries, while *C. labiata*, *C. pycnoclavata*, *C. gigas*, and *C. triana* are badly affected.

In the author's life history studies of the pest, which extended over a period of 18 months, *C. labiata* and *C. triana*, inclosed in a wire cage were used as host plants. The first brood emerged the last week in February, two broods emerged in March, two in April, etc. The egg is deposited beneath the epidermis at the base of the young growths and the injury can be detected by a swelling. The period from oviposition to emergence covers at least three months in the winter. Upon hatching out the larvæ feed upon the soft interior of the pseudo-bulb, forming small cavities in which they later pupate, and as many as 10 may be found in the same cavity. A single female was observed to make 34 piercings within 18 hours, and it is thought possible that each female lays more than 50 eggs during the three or four days of her life.

In fumigation for the destruction of the adults, which must be done every night, Nicotume proved much more satisfactory than pyrethrum, though neither is sufficiently effective. Spraying for the pest does not appear to be practicable. In experimental injections of ether, chloroform, carbon bisulphid, nicotine solution, and pure air separately into infested growth, the first three killed both insect and infested part of the plant. While nicotine solution killed the insect in the cavity it did not permeate the plant tissues. The author found that the simple piercing of the shoot, i. e., the injection of pure air into the cavity, kills the insects, and he concludes that piercing the swollen portion is a satisfactory method of control just so long as the cavity is exposed to the air, but if the stab is made in the wrong place or if only one or two cavities are stabbed, reproduction of the flies is not prevented. The destruction of the infested parts appears to be the best method of control known, and in doing so all growths less than 18 months old should be examined at least once a week, unless the grower has not imported orchids or had no infestations for a year or longer.

A revision of hymenopterous insects of the tribe Cremastini of America north of Mexico, R. A. CUSHMAN (*Proc. U. S. Nat. Mus., 53 (1917), pp. 543-551*).—This revision includes descriptions of one genus (*Neocremastus*) and 29 species new to science. Among the new species are *Cremastus flaviceps* reared

from *Pulvinaria bigeloviae* at Grand Junction, Colo., and Port Lavaca, Tex.; *C. minor* reared from the blackhead fireworm at Whitesbog, N. J., from *Gnori-mochemus artemisiella* at Chicago, Ill., from *Gelechia* sp. at Benton Harbor, Mich., from the pecan cigar case-bearer at Victoria, Tex., and from *Eucosma arvensana* on *Ambrosia trifida* at Washington, D. C.; *platynotus* and *Platynota faredana* at Tempe, Ariz.; *C. tortricoides* and *C. epagages* reared from *Epagages sulfureana* at Nashville, Tenn.; *C. evetrix* from *Evetrix bushnellii* at Port Bayard, N. Mex.; *C. cleridivorus* reared from the larvæ of *Enoclerus pariguttatus* at Kanawha Station, W. Va., Tryon, N. C., and Lawrence, Kana.; *C. rose* from rose hips in company with *Rhynchytes bicolor* but which were also apparently infested with a lepidopterous larva, at Vienna, Va.; *C. tetralopha* from *Tetralopha subcanalis* at Monticello, Fla.; and *C. mordellistena* from *Mordellistena morula* in Colorado.

The author has found that *C. decoratus* has apparently been introduced into the United States with one of its European hosts, *Evetrix buoliana*, a specimen having been reared from that host on Long Island, N. Y. *C. forbesii*, originally described from specimens reared from *Acleria minuta*, is represented in the National Museum by specimens reared from *Gelechia trialbamaculella* at Pemberton, N. J., blackhead fireworm at Pemberton, N. J., *G. confusella* at Benton Harbor, Mich., and *Epistimus argutus* at East River, Conn.

Notes and descriptions of miscellaneous chalcid flies (Hymenoptera), A. A. GRANTLY (Proc. U. S. Nat. Mus., 53 (1917), pp. 445-450).—Twelve species representing ten genera are described as new. Among these are *Tumidiacapus ophagus*, many specimens of both sexes of which were reared from eggs of *Oryza celox*, at Coimbatore, Southern India; *Abdella americana* reared from psid eggs in Elymus, at Salt Lake City, Utah; and *Symplecsis ancyla* reared from *Ancylis* sp. at Whitesboro, N. J.

The fish louse (*Argulus foliaceus*), R. MERLE (Sci. Amer. Sup., 84 (1917), No. 2189, p. 373, fig. 1).—A brief account of *A. foliaceus*, which destroys carp, etc., with a discussion of preventive and remedial measures.

Brazilian cecidia of plants belonging to the families Compositæ, Rubiacæ, Tillacæ, Lythracæ, and Artocarpacæ, J. S. TAVARES (Broteria, Ser. Zool., 15 (1917), No. 3, pp. 113-181, pls. 6, figs. 4).—This contribution to the knowledge of Brazilian cecidia includes descriptions of 4 genera and 11 species new to science.

## FOODS—HUMAN NUTRITION.

Chemistry of food and nutrition, H. C. SHERMAN (New York: The Macmillan Co., 1918, 2. ed., rev. and enl., pp. XIII+454, figs. 16).—This book has been rewritten and enlarged to include the results of the more important investigations in nutrition since the first edition (E. S. R., 24, p. 759). Among these may be mentioned the greatly extended knowledge of the nature and nutritive value of individual proteins and of the chemical changes involved in the intermediary metabolism of carbohydrates, fats, and proteins; new data on energy requirements under different conditions; and additional facts concerning inorganic constituents, particularly calcium and phosphorus, and the maintenance of neutrality in the body. Perhaps the most interesting and significant of the recent investigations are those which have led to the establishment of new factors essential to the nutritive requirements of the body, the unidentified substances referred to as "vitamins" or as "fat soluble A" and "water soluble B." These are described in the chapters on antiscorbutic and antineuritic properties of food in relation to growth and development.

The book closes with a chapter on dietary standards and economic use of food in which the problems of an adequate diet are discussed from the viewpoint of

nutritive value and economy. While emphasizing the fact that under modern conditions scientific dietary standards based on a knowledge of food chemistry and nutritive requirements "constitute the most rational guide to the formation of hygienic and economic habits in the use of food," the author states that too much weight must not be attached to any attempt to state the requisites of an adequate diet in terms of quantities of certain nutrients.

Many additions and some changes have been made in the tables in the appendix. The table of ash constituents contains many hitherto unpublished analyses, and the data are uniformly given as percentages of the elements and not of their oxides. An extensive list of references to the original literature is given at the end of each chapter.

Special attention has been given throughout the book to the task of presenting the striking results of the most recent investigations in nutrition in such a manner as "to make clear their importance without giving exaggerated impressions and with due emphasis upon the fact that on many significant points no interpretation which can now be offered is necessarily tentative."

Food in war time, G. Lusk (*Philadelphia and London: W. B. Saunders Co.* 1918, pp. 46).—This book contains three short articles—A Balanced Diet, Calories in Common Life; and Rules of Saving and Safety.

[The work of the Office of Home Economics, U. S. Department of Agriculture], Mrs. J. C. GAWLER (*Gen. Fed. (Women's Clubs) Mag.*, 16 (1917), No. 1, p. 26).—A summary of data regarding the organization and work of the U. S. Department of Agriculture with special reference to war-time activities.

What the Department of Agriculture is doing to aid women's war work (*Gen. Fed. (Women's Clubs) Mag.*, 16 (1917), No. 9, pp. 17, 18).—Information is given regarding the general work of the U. S. Department of Agriculture in home economics, its extension work, and its relations to the Food Administration.

Conservation of food by substitution with suggestive menus for families of two and five, prepared as far as possible with reference to emergency food conditions (*Mich. Agr. Col., Dom. Sci. and Home Econ. Ext. Dept. [Pub., 1918], pp. 96*).—This bulletin discusses the five food groups and the planning of meals to include proper proportions of food from each group. Suggestive menus for fall, winter, spring, and summer for families of two and five prepared as far as possible with reference to emergency food conditions are given.

[Food conservation], DORA E. WHEELER (*Women's Munic. League Boston Bul.*, 9 (1917), No. 1, pp. 11-20, figs. 2).—Data on the saving of wheat and substitutes for sugar and recipes for Italian dishes are included.

Notes from the Department of Food Sanitation and Distribution (*Women's Munic. League Boston Bul.*, 9 (1918), No. 2, pp. 27-29).—Recipes for the use of corn and corn products and inexpensive Italian dishes are given.

Economy in feeding the family.—I, Some essential facts regarding nutrition, J. P. STREET and E. H. JENKINS (*Connecticut State Sta. Bul.* 196 (1917), pp. 15).—This bulletin is the first of a series designed to help "those who provide the food of families to have a clearer understanding of the principle of nutrition, of the amount of food necessary for health and efficiency, and of the most economical methods of buying and preparing food." It contains a short discussion of the following topics: The uses of food, the chemical composition of food, the special uses of the proteins, carbohydrates and fats of the food, the expression of the quantities of food ingredients and their energy, the number of calories needed by the body each day, and the application of the knowledge of calories to the preparation of the daily meal. A table is included

showing the number of calories yielded by standard portions of various common foods.

**Economy in feeding the family.**—II, The cereal breakfast foods, J. P. TRACY (*Connecticut Sta. Bul.* 197 (1917), pp. 19-43).—In this popular discussion data are reported in tabular form showing the cost, net weight per package, total calories, percentages of water, fat, crude fiber, protein, ash, carbohydrates other than fiber, and starch, and of the food value and cost of serving of a large number of breakfast foods and other cereal preparations.

**Other grains than wheat in bread making,** W. L. STOCKHAM (*North Dakota Sta. Bul.* 123 (1917), pp. 100-105, figs. 3).—The need for including a greater proportion of the wheat berry in flour and the use of other grains in bread making are discussed. In tests reported admixtures of different extractions of rye and wheat flour in varying proportions were used in bread making, as were a series of blends of barley flour and wheat flour. Photographic illustrations of the resulting loaves are given.

**Milling value of barley,** T. SANDERSON (*North Dakota Sta. Bul.* 123 (1917), pp. 106, 107).—Experimental data on barley milling are reported and the economic use of barley discussed.

"According to the . . . figures [given], it would be possible to use an amount of barley flour that would produce a loaf of bread very little below the quality of bread made from all wheat flour and at less cost than if made from all-wheat flour."

[Milling and flour investigations] (*Kansas Sta. Rpt.* 1916, p. 22).—From the investigations noted, it is concluded that the "baking qualities of flour are markedly influenced by protein decomposition products, and that a large amount of nitrogen in amino form is an indication of poor baking qualities."

In bacteriological analyses of 51 samples of flour, "ropy" bread organisms were found in 40 per cent. Since these organisms were found in the better grades of flour in much higher proportion than the corresponding losses from "ropy" indicate, the ultimate source of the trouble is ascribed to bakery practice rather than the flour used.

A large number of baking tests to determine the effect of egg albumin as an ingredient of baking powder showed no measurable effect in the amounts used.

**Six years' milling tests by grades,** E. F. LADD, ALMA K. JOHNSON, and T. SANDERSON (*North Dakota Sta. Spec. Bul.*, 4 (1917), No. 17, pp. 411-455).—This bulletin contains a summary of the results of milling tests carried on from 1911 to 1916, inclusive, and previously noted (*E. S. R.*, 34, p. 759; 36, p. 464, 471; 37, p. 663).

**The contributions of zoology to human welfare,** H. M. SMITH (*Science*, n. ser., 47 (1918), No. 1213, pp. 299-301).—The author calls attention to the service rendered by zoologists in learning the best methods of fish production and protection in the United States.

**Sanitation of steamers** (*Cal. Bd. Health Mo. Bul.*, 13 (1918), No. 8, pp. 353-361, figs. 2).—In this account of inspection work by E. T. Ross some information is given regarding methods followed in preparing food and regarding sanitary conditions, which in passenger steamers inspected were generally found to be quite good. The sanitary condition of employees' living quarters and similar topics are discussed.

**Lye unnecessary with hot water [for sterilizing glasses]** (*Cal. Bd. Health Mo. Bul.* 13 (1918), No. 9, p. 402).—This editorial states that the recent California law requiring sterilization of drinking glasses has met with some confusion in interpretation.



"The facts are that the soda solution is an approved substitute for sterilization by steam and boiling water, but it is not required that the solution be used hot. . . . It is intended that the lye solution shall be used when arrangements for heating are not available."

A comparison of three methods of determining defective nutrition, F. A. MANNY (*Arch. Ped.*, 35 (1918), No. 2, pp. 2-9).—Data compiled from a study of defective nutrition among 2,538 pupils in two New York City schools are given here. The basis upon which the need of care is determined varies among physicians. Three methods for determining the condition of defective nutrition are here compared. The weight and height measurements of each child were taken and an experienced physician examined the pupils, classifying them into four nutrition grades (1) superior condition, (2) passable, (3) border line, and (4) very bad according to the Dunfermline scale. Some results of the comparison are summarized below:

"Among these 2,538 children the number assigned to care was greatest according to the scale, second on the basis of weight-age, and least on that of weight-height. With reference to sex and age the scale and the height-age basis showed deterioration with increased age for the boys and the reverse condition for the girls. The other two bases show deterioration in both sexes, but this condition was much more marked among boys on the weight-age basis and for girls on the weight-height basis.

"The scale groups requiring care would have been detected nearly twice as well by the weight-age basis as by the weight-height. The weight-age groups requiring care would have been detected nearly three times as well by the scale as by the weight-height basis. The weight-height groups requiring care would have been detected nearly half as well again by the scale as by the weight-age basis.

"The underheight group shows closest relation to the weight-age underweight group—91.9 per cent. Next in order comes those defective according to the scale—78.4 per cent—while only 13.5 per cent of those underheight are also underweight for their height.

"Even weight and even height decrease with age—more rapidly with the boys than with the girls. Overweight and overheight increase more rapidly with the girls than with the boys, and the girls of 14 show actually less underheight than do those of 7. The girls increase slightly in underweight and the boys increase in percentage of both underweight and height."

It would seem from these data that any adequate system of diagnosis will make use of the advantages of both weight relationships and points to the need of careful study in order to work out a system of diagnosis. The Dunfermline scale is an attempt in this direction.

On the assumed destruction of trypsin by pepsin and acid.—III, Observations on men, J. H. LONG and MARY HULL (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 7, pp. 1493-1500).—"The observations of this paper on the human subject justify the conclusions reached in previous work performed in vitro and with dogs<sup>1</sup> that under certain not unusual conditions trypsin may resist the action of pepsin and acid in the animal stomach through a considerable period following the ingestion of the ferment.

"It is evident that the action of this ingested trypsin is fully as pronounced in the quantities used, as is that which seems to be carried back to the stomach, along with bile, by the regurgitation of duodenal fluid, but it can not be said that either effect is very important physiologically. The ingestion of a few

<sup>1</sup> *Jour. Amer. Chem. Soc.*, 38 (1916), No. 8, pp. 1620-1638; 39 (1917), No. 1, pp. 162-174.

milligrams of commercial pancreatin or trypsin could not have great importance as a therapeutic measure.

Some tryptic digestion may undoubtedly take place in a slightly acid medium, and therefore, at times, in the stomach."

### ANIMAL PRODUCTION.

The relative value of field roots, F. T. SHUTT (*Canada Expt. Farms Rpts.* 1916, pp. 115-121).—Analytical data are reported for a number of years on the composition of varieties of mangels, turnips, and carrots. For 1915, mangels varied in dry matter from 7.32 per cent to 13 per cent, and in sugar from 2.86 to 6 per cent. A test was made of the influence of heredity in mangels with two widely different varieties, Gate Post and Giant Yellow Globe, which were planted side by side for a period of 16 years. Gate Post invariably proved superior, averaging for the whole period 23 per cent more dry matter and 33 per cent more sugar than Giant Yellow Globe.

Thirty-three varieties of turnips were analyzed to determine the average composition for a 10-year period. For the year 1915 there was a difference of 3.58 per cent of dry matter, indicating that 2,000 lbs. of the best variety was equivalent to 3,860 lbs. of the poorest. The sugar content was fairly constant, averaging approximately one-fifth that of mangels.

Analyses made in 1915 with 10 varieties of carrots showed a difference in dry matter of 2.84 per cent between the best and poorest varieties, indicating that 2,000 lbs. of the former was equal to 2,665 lbs. of the latter.

The average composition of mangels, grown for 11 years, was, dry matter 11.02 and sugar 5.89 per cent; for turnips, grown for 10 years, dry matter 10.2 and sugar 1.27 per cent; and for carrots, grown for 10 years, dry matter 10.37 and sugar 2.69 per cent.

Utilizing the sorghums, T. F. HUNT (*California Sta. Circ.* 187 (1917), pp. 7).—Attention is called to the decreasing number of live stock due to present world conditions. To again increase this production is a slow process, and the first requisite is more feed. This circular emphasizes the value of the sorghums under California conditions and methods of conserving and feeding them.

Silage investigations (*Kansas Sta. Rpt.* 1916, p. 21).—It is deemed possible, but difficult, to make silage from alfalfa alone. It requires rigid exclusion of the air, and the addition of an easily fermentable carbohydrate, as molasses, corn chop, cane butts, or rye, is helpful, although these methods are not very practical. Meal from germinated corn is more effective than that from corn not germinated.

Inspection of commercial feedstuffs, P. H. SMITH (*Massachusetts Sta. Control Ser. Bul.* 7 (1917), pp. 30).—The results of the feeding stuffs inspection from September 1, 1916, to April 1, 1917, are given, including analyses of 1,082 samples. Prices for the period have ruled high and supplies scarce, but with few exceptions goods offered have been as represented. Carbohydrate feeds have ruled relatively higher in price than proteins.

The feeds analyzed were cottonseed, linseed, corn germ, peanut, sesame, and gluten meals; distillers', brewers', yeast, and vinegar grains; malt sprouts; wheat middlings, red dog flour, and low-grade flour; durum wheat products; rye middlings; corn meal, corn bran, and corn and cob meal; ground oats and oat groats; hominy feed; provender; dried beet pulp; cut clover; alfalfa meal; and molasses, mixed, and proprietary feeds.

The analyses of cottonseed meals showed a lowered protein content, indicating the addition of ground hulls. The peanut oil cake, evidently without the hull, was of excellent quality.

An appended article on The Grain Problem, by J. B. Lindsey, discusses the relative values of feeds and their selection under present conditions.

[Miscellaneous analyses], F. T. SHURT (Canada Expt. Farms Rpts. 1914, pp. 121-125, 178, 179).—Analyses of bran, barley flour, oat flour, rice meal, flax chaff, flax shives, elevator dust, mangels, several proprietary and by-product feedstuffs, butter, poultry grit, and an egg preservative are reported. A test of the egg preservative indicated no advantage over saturated limewater.

Grazing experiment (Kansas Sta. Rpt. 1916, pp. 20, 21).—Plots prepared until the predominant species matured seed showed good results. Seeding with a mixture of tame grasses did not establish a stand. With sweet clover, mowing on level land was practical and kept down weeds.

Cattle feeding, A. D. FAYLE (Wyoming Sta. Bul. 117 (1917), pp. 55-64).—Experiments were made during three years comparing oat and pea silage with alfalfa hay. The grain rations varied but were the same with lots directly compared.

The experiments during 1915-16 with beef cows were interrupted, but with no elaborate results were obtained the data indicated that 7 lbs. of a 15% alfalfa ration could be replaced by 15 lbs. of oat and pea silage.

During the winter of 1916-17 the cows were fed for 16 weeks as one lot with and without oat and pea silage reversed every 4 weeks. With silage in the ration they made an average daily gain per head of 0.55 lb. with a ration costing 13.8 cts. daily. Without silage in the ration they made an average daily gain of 0.13 lb. on a daily cost of 13.7 cts. These results taken with others previously obtained (E. S. R., 34, p. 467) indicate that oat and pea silage can be substituted for alfalfa hay at 2 lbs. of silage to 1 lb. of hay.

With growing cattle in 1914-15 during 161 days those with oat and pea silage in the ration made an average daily gain per head of 0.84 lb. on a daily cost of 11 cts. Those without silage in the ration made a daily gain of 0.8 lb. at a cost of 13.4 cts. Approximately 9.5 lbs. of silage replaced 7 lbs. of alfalfa.

During 113 days of the winter of 1915-16 growing heifers with oat and pea silage in the ration made an average daily gain per head of 1 lb. costing \$4 cts. daily. Without silage they made an average daily gain of 0.6 lb. on a ration costing 9.4 cts. per day. Ten lbs. of the silage more than replaced 5 lbs. of alfalfa. With grain and alfalfa the cost of 100 lbs. of gain was \$15.92, while with the substitution of a part of the alfalfa with the silage it was \$8.37.

In 16 weeks' feeding with growing cattle during the winter of 1916-17 the lots were reversed every 4 weeks. With silage in the ration they made an average daily gain per head of 1.4 lbs. on a ration costing 10.8 cts. per day. Without silage in the ration they made an average daily gain of 0.63 lb. on a ration costing 11.4 cts. daily. With grain and alfalfa it cost \$18.26 per 100 lbs. of gain, while with silage in the ration it cost \$7.70.

[Cattle feeding investigations] (Kansas Sta. Rpt. 1916, pp. 34-36).—One hundred head of 3-year-old heifers were divided into five lots and fed for 20 days during the winter. The rations were feterita silage and alfalfa, Kafir corn silage and alfalfa, Kafir corn stover and alfalfa, Kafir corn stover and alfalfa on range lot, and Sudan stover and Kafir corn silage. Kafir corn silage and alfalfa made the greatest gain, the animals averaging 0.87 lb. daily at a cost of 6.1 cts. per pound. The Kafir corn silage was better preserved and more palatable than the feterita silage.

In another test of 120 days' duration 40 heifers were fed silage, alfalfa, and straw and another 40 the same feed with the addition of 4.54 lbs. of corn-and-cob meal and 1 lb. of linseed meal a day. The first lot made an average daily gain per head of 0.92 lb. at a total feed cost of \$4.73 per head. The second lot

grain fed, made an average daily gain of 1.88 lbs. at a total feed cost of \$11.43 per head.

Beef cattle, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1916, pp. 57-122, pls. 5*).—An experiment was carried out at the station at Charlottetown, P. E. I., from November 1, 1915, to March 8, 1916, to determine the gains and profits in fattening beef and dairy types of steers. The grain mixture fed was made up of bran, barley, and oats, with a roughage of timothy, oat, and clover hay, turnips, and mangels. Some of the results obtained are shown in the following table:

*Tests in fattening beef and dairy types of cattle.*

Lot.	Type.	Number of animals.	Average daily gain per steer.	Average cost per pound of gain.	Dressed weight per steer.	Profit per steer.
			Lbs.	Cts.	Per cent.	
I	Beef (two good, one fair, one rangy).....	4	2.33	7.90	54.3	\$16.09
II	Dairy (Holstein grades).....	4	2.08	8.50	51.9	12.87
III	Beef (Shorthorn).....	4	1.90	9.05	57.3	12.21
IV	Dairy (mixed grades).....	4	2.15	8.06	54.5	17.06
V	Dairy (Holstein grades).....	3	2.30	7.98	57.0	17.72

The third-year results are reported of an experiment carried out at the Nappan Station, N. S. The objects of this trial were to determine the results of increasing the root and grain ration 50 per cent for light and heavy-weight steers, to find the profit in feeding these two types, and to show the value of molasses in finishing beef.

Sixteen well-bred Shorthorn steers were divided into four lots of 4 steers each, good butchers in lots 1 and 3 and good stockers in lots 2 and 4, the latter being somewhat thinner. The steers were fed a mixture of 40 per cent barley and oats, 40 per cent bran, 10 per cent oil cake, and 10 per cent cottonseed meal, with a roughage of turnips and clover hay, and lots 2 and 3 receiving 50 per cent more roots and meal than lots 1 and 4. Half of each lot received, in addition to the regular ration, 2 lbs. of molasses per head per day.

Some of the results are shown in the following table:

*Results of steer-feeding experiment, January 1 to April 3, 1916.*

Lot.	Type.	Average daily gain per steer.	Daily cost of feed per steer.	Average cost per pound of gain.	Profit per steer.
		Lbs.	Cts.	Cts.	
I	Butchers (light fed).....	1.927	20.24	10.50	\$16.13
III	Butchers (heavy fed).....	2.358	25.66	11.31	13.68
IV	Stockers (light fed).....	1.811	20.24	11.17	14.28
II	Stockers (heavy fed).....	1.941	25.66	13.72	10.98

The average daily gain of the steers with molasses in the ration was 2.17 lbs. at a cost of 11.49 cts. per pound, and without molasses 1.77 lbs. at 12.42 cts. The average profit per steer was \$13.57 with molasses and \$13.90 without. The average for three years with good butchers shows a daily gain of 2.252 lbs. at a cost of 10.33 cts. per pound for heavy-fed steers, as compared with a daily gain of 2.094 lbs. at a cost of 8.646 cts. per pound for the light fed; with good stockers a daily gain of 2.114 lbs. at a cost of 11.08 cts. for the heavy fed, as

compared with 1.9 lbs. at a cost of 9.57 cts. with the light fed. While heavy feeding increased the weight, it also increased the cost. Molasses also produced an increase in weight, but at a cost above \$20 or \$23 per ton it produced no profit during the three years of the experiment.

From the three years' results, it appears that the greatest profit can be secured with 40 to 50 lbs. of roots and an average of 6.5 lbs. of grain per day, beginning with 2 or 3 lbs. and finishing with about 10 to 12 lbs. while decreasing the roots.

In an experiment conducted at the station at Kentville, N. S., to compare turnips with silage 24 steers were divided into two lots of 12 each. Each of the steers in lot 1 was fed 60 lbs. of pulped turnips for the first six weeks, 50 for the next two, 40 for the next two, and 35 for the remaining six; those in lot 2, 40 lbs. silage per day for the first six weeks, 35 for the next two, 30 for the next two, and 25 for the remaining six. The grain ration, made up of wheat bran, cottonseed meal, ground oats, and corn meal, 2:2:1:1, was fed each steer as follows: One lb. each per day for the first week, 2 lbs. for the second, 4 lbs. for the next two, 6 lbs. for the following two, 7 lbs. for the next two, 8 lbs. for the next four, and 9 lbs. for the remaining four, an average of 6.17 lbs. meal per steer per day. Ten lbs. of mixed hay of fair quality was fed each steer daily.

During the 120 days of the experiment the turnip-fed lot made an average daily gain per head of 1.84 lbs. at a cost of 11.31 cts. per pound of gain, while the silage-fed lot gained 1.87 lbs. at a cost of 11.22 cts. The profit per steer for the former was \$8.40, and for the latter \$8.48. With turnips at \$2 per ton and silage \$3 per ton there is little difference indicated in the cost of the two rations.

Thirteen grade Shorthorn steers costing \$6.23 per 100 lbs. and 11 dairy type steers costing \$4.57 per 100 lbs. were fed at Fredericton, N. B., on rough crops of the farm to test the effect of the feeding on these types. The animals were fed for 140 days, beginning December 1, on a ration of 50 lbs. of turnips, 3 lbs. of grain mash, and hay. The Shorthorn grades made an average daily gain of 1.26 lbs. at a cost of 13.3 cts. per pound, while the dairy type made a daily gain of 1.11 lbs. at a cost of 15.1 cts. per pound. The Shorthorns sold for \$8 per 100 lbs., yielding a net profit of \$5.39 per animal, and the dairy type for \$6.34, yielding a profit of \$1.84 each.

An experiment was carried out at Brandon, Man., during the winter of 1914-15 to compare the effects of feeding cattle in a warm stable with feeding in an open shed and corral. A comparison was also made of mixed grass and green oat hay with straw and corn silage and with alfalfa hay. The cattle at the beginning of the experiment (November 13) cost \$6.46 per 100 lbs. They were divided into four lots and were fed the same grain ration, consisting of chopped oats and chopped barley or corn, 2:1. The grain ration, started at 2 lbs. daily, was gradually increased to 8 lbs., at which rate it remained for about two months. The experiment was closed May 24, 1915, when the cattle were sold at \$8.75 per 100 lbs.

The stable-fed steers showed a higher gain than the open-shed animals, a result contrary to former experiments. While the animals on hay made a greater gain than those on straw and silage, the latter brought a greater profit. The alfalfa hay, though higher in price, gave larger returns than the other hays.

At Indian Head, Sask., during the fall of 1915 60 steers were divided into five lots of 12 each for a trial of the different methods of wintering cattle. The lots were fed for 135 days, being given equal amounts of grain and all the prairie hay they would clean up. The two stable lots were fed in addition silage and roots.

Lot 1, bush shelter, made an average daily gain of 1.63 lbs. at a cost of 13.81 cts. per pound; lot 2, open corral, 1.6 lbs. at 13.92 cts.; lot 3, corral and open shed, 1.72 lbs. at 13.07 cts.; lot 4, stable, with addition of silage to ration, 1.56 lbs. at 11.75 cts.; and lot 5, stable, with addition of roots to ration, 1.72 lbs. at 10.77 cts.

In the Lethbridge (Alta.) section, where alfalfa is the principal field crop and stock raising has not progressed to the point where all the feed is utilized locally, the problem of disposing of the alfalfa hay is an important one. An experiment was carried out to determine the advisability of feeding alfalfa together with some other roughage.

Three lots of 21 steers each were fed as follows: Lot 1, alfalfa hay; lot 2, alfalfa hay and green oat sheaves, 3:1; and lot 3, alfalfa hay and dry corn fodder, 3:1. Of this roughage the steers were fed all they would clean up well, and in addition they were given small quantities of equal parts of crushed oats and barley. With alfalfa hay, valued at \$10, green oat sheaves \$10, dry-corn fodder \$5, and crushed barley and oats \$20 per ton, lot 1 made an average daily gain per head of 1.4 lbs. at a cost per pound of 13 cts.; lot 2, 1.6 lbs. at 12 cts.; and lot 3, 1.2 lbs. at 14 cts. The average net profit per steer was \$2.31, \$4.65, and \$1.27, respectively, for the three lots. It is thought that it pays to feed some other roughage with alfalfa as it gives variety to the ration and the animals eat more and make greater gains.

On December 1, 1915, an experiment was begun at Lacombe, Alta., with 197 yearling and two-year-old steers and heifers in testing the value of various hays and fodders as roughage. The animals were fed the same grain ration consisting of equal amounts of oats and barley well ground. The results were as follows:

*Beef-feeding experiments with various roughages.*

Lot	Roughage.	Number of steers.	Average daily gain per steer.	Cost per pound of gain.	Profit per steer.
			Lbs.	Cts.	
1	Prairie hay.....	20	1.756	8.57	\$13.06
2	Prairie hay and oat straw.....	113	.762	17.62	9.01
3	Prairie hay and green sheaves.....	19	1.508	11.09	10.56
4	Green sheaves.....	20	1.220	13.36	8.96
5	Timothy and alsike hay.....	20	.921	20.70	5.84

The animals in lot 1 made fair gains, were consistent steady feeders, and were well finished at the close. Those in lot 2, fed hay and straw in separate racks, ate the hay but neglected the straw. The animals in lot 4 were off feed at times due to scouring. Those in lot 5 were well finished.

Silage for beef cattle investigations (*Kansas Sta. Rpt. 1916, p. 20*).—In the fourth trial with yearling heaves, those receiving a ration of ground corn, cottonseed meal, and alfalfa and silage as roughage showed more finish and bloom and dressed out a higher percentage but with a greater cost per unit of gain than those on other rations. Corn-and-cob meal made slower but cheaper gains than ground corn, while Kafir corn meal put on slower gains at a still lower cost. Where corn can not be secured at a reasonable price, Kafir corn seems to make a good substitute. Cattle fed no silage made the greatest gains and showed almost as much bloom as the silage lots.

Russian thistle silage for the maintenance of range cattle (*New Mexico Sta. Rpt. 1917, pp. 74, 75*).—A small cement silo was filled with silage made from Russian thistles of various stages of maturity varying in height from 1.5

to 3.5 ft. The filling was made in September and the silo opened in January. The first 5 ft. was spoiled and the remaining silage was of a dark brown color and strong acid odor. On being exposed to the air for a few hours it turned darker and developed a very unpleasant odor. When substituted for corn silage young stock and dry cows ate it fairly well. On a ration of 10 lbs. of alfalfa hay and 10 lbs. of the silage daily young heifers lost 10 lbs. each in 10 days and appeared to be hungry most of the time. This silage can not be said to be a good feed.

**Sheep feeding.—VII. Fattening western lambs, 1916–17, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 202 (1917), pp. 3–20; popular ed., pp. 7).***—A continuation of work previously reported (*E. S. R.*, 36, p. 568), and made to obtain further data on fattening lambs. The experiments include a comparison of various roughages alone and in combination, as alfalfa hay, clover hay, and corn silage; the value of cottonseed meal and ground soy beans as supplements; and the influence of shearing and of sheltering on fattening lambs. Western lambs from Colorado were used, divided into nine lots of 25 each, and the tests continued from November 2 to March 2.

**I. Corn silage alone v. corn silage and dry roughage for fattening lambs.**—In this comparison the lambs in one lot on corn silage were given a feed of clover hay every fifth day to maintain their appetites. This was found necessary in former experiments where the lambs developed fickle appetites when fed on corn silage alone. The different lots were fed a basal ration of shelled corn and cottonseed meal (7:1). The lot with corn silage in addition as roughage (lot 1) gained an average of 17.5 lbs. per head at a cost of 15.43 cents per pound. The lot on corn silage as roughage with a feed of clover hay every fifth day (lot 6) gained 28.6 lbs. per head at a cost of 10.97 cts. per pound. The lot with clover hay and silage roughage, each as wanted (lot 7), gained 36.5 lbs. per head at a cost of 9.92 cts. per pound.

The silage-fed lot ate less grain than the other two lots. When finished they were valued at 13.5 cts. per pound and returned a profit of 83 cts. per head. The lot on silage with clover every fifth day was valued at 13.9 cts. per pound and returned a profit of \$2.23 per head. The lot with silage and clover hay at will was valued at 14.25 cts. per pound and returned a profit of \$3.18 per head.

**II. Clover hay v. alfalfa hay as roughage for fattening lambs.**—This experiment, comparing clover hay with alfalfa hay, is the fourth carried out for this purpose. In two of these trials clover has produced the best results and is two others the alfalfa. Where there was a difference in the quality of the hay, the better one, regardless of kind, produced the best results. While the animals consumed larger quantities of the poorer hay, the rate of gain was in every case in favor of the higher quality.

The lambs in this experiment on shelled corn and clover hay of medium quality (lot 3) gained an average of 34.4 lbs. per head at a cost of 9.71 cts. per pound. Those on shelled corn and alfalfa hay of excellent quality (lot 4) gained 36.6 lbs. per head at a cost of 9.12 cts. per pound. The clover-fed lambs were valued at 13.75 cts. per pound and returned a profit of \$2.69 per head, while the alfalfa-fed were valued at 14 cts. per pound and returned a profit of \$3.22 per head.

**III. Alfalfa hay v. alfalfa hay and corn silage for fattening lambs.**—Lambs fed shelled corn, alfalfa hay, and corn silage (lot 5), gained an average of 34.6 lbs. at a cost of 9.85 cts. per pound. The lambs were valued at 14.1 cts. per pound and returned a profit of \$2.99 per head. This lot is compared with that in the previous experiment (lot 4) receiving shelled corn and alfalfa hay.

**IV. Ground soy beans v. cottonseed meal as supplement to ration for fattening lambs.**—In this experiment the ground soy beans and cottonseed meal were

fed as supplements to shelled corn, clover hay, and corn silage. The lambs fed ground soy beans (lot 8) gained an average of 35.1 lbs. each at a cost of 9.76 cts. per pound, were valued at 14.15 cts. per pound, and returned a profit of \$3.09 per head. Comparison was made with lot 7, reported under series I.

V. *Influence of shearing on fattening lambs.*—In this experiment, lot 2, which was shorn in the beginning of the test and yielded 57 lbs. of wool, was compared with lot 7, as previously noted. The shorn lambs consumed slightly more feed and gained an average of 33.8 lbs. per head at a cost of 10.72 cts. per pound, were valued at 11.75 cts. per pound, and made a profit of 96 cts. per head.

VI. *Open shed v. barn as shelter for fattening lambs.*—In this experiment the lambs were all shorn. Those in the barn (lot 9) ate the same quantity of grain and silage but less hay than those in the open shed (lot 2). The barn-fed lambs gained an average of 33.1 lbs. each at a cost of 10.63 cts. per pound, were valued at 11.25 cts. per pound, and returned a profit of 51 cts. per head. This experiment, together with five similar experiments, showed higher profits from feeding lambs in open sheds than in the barn.

Sheep, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1916, pp. 532-559, pt. 4*).—Two experiments were carried out with lambs at the Central Experimental Farm, Ottawa, to compare the protein in various meals, to discover the comparative value of two new protein meals recently introduced into Canada, and to find the best nutritive ratio for fattening lambs. The 50 lambs in each experiment were divided into five lots of 10 lambs each, and besides protein feeds were given equal amounts of hay and silage. The grain was fed at the rate of 5 oz. per head in the beginning, increasing 2 oz. weekly until it reached 20 oz. in the seventh week, at which rate it remained until the end of the experiment. In the first experiment "short-keep" lambs were fed for the Christmas market from November 17 to December 15, a period of 28 days; in the second, "long-keep" lambs were fed from November 17 to February 9, a period of 84 days.

Average results from both experiments are shown in the following table:

*Average results of lamb-feeding experiments.*

Lot	Kind of grain ration.	Nutritive ratio of grain-mixture.	"Short-keep" lambs.			"Long-keep" lambs.		
			Average gain. per animal.	Cost to produce 1 lb. of gain.	Net profit per animal.	Average gain per animal.	Cost to produce 1 lb. of gain.	Net profit per animal.
			Lbs.	Cts.		Lbs.	Cts.	
1	Corn meal.....	1:6.7	10.8	4.3	\$1.85	18.7	10.1	\$1.99
2	Gluten meal.....	1:4.8	11.2	4.1	1.82	18.2	10.3	1.86
3	Cottonseed meal.....	1:4.3	10.1	4.6	1.77	15.7	11.9	1.66
4	Linseed meal.....	1:4.1	9.5	5.0	1.68	13.1	14.7	1.33
5	Peanut meal.....	1:3.9	12.8	3.7	2.03	17.5	11.0	1.83

During the winter of 1915-16, two lamb-feeding experiments lasting 110 days each were carried out at Charlottetown, P. E. I., beginning December 1, to compare clover hay with mixed-grain hay (oats and barley cut in the milk size), and to compare a heavy grain ration with a light grain ration. Each experiment included two lots of 10 lambs each. In the first experiment, in addition to the roughage under test, both lots were fed turnips and a heavy grain ration of barley, oats, and bran. Lot 1 received the clover hay as roughage; lot 2 received the mixed-grain hay up to February 20, when the supply became exhausted and clover hay was substituted. Up to February 20, lot 1



made the better and more economical gains, from which it is concluded that clover hay is the better roughage for fattening lambs.

In the second experiment each lamb of lot 1 started with 10 oz. of grain per day and each lamb of lot 2 with 6.4 oz., both lots finishing with 18 oz. per lamb. During the period of the experiment the lot on the heavy grain ration made an average gain per animal of 0.162 lb. daily, at a cost of 15 cts. per pound; that on the light grain ration averaged 0.126 lb. daily, at 17.9 cts. per pound.

A trial was made at Agassiz, B. C., of fattening ram and wether lambs on rape. The lambs were pure-bred Dorset Horned, the rams being the better individuals. The rape was only a fair crop and would support only 11 lambs to the acre for 54 days. The lambs were run 14 days without grain and were then fed 1 lb. each per day of a mixture of 4 parts whole oats, 2 parts crushed barley, 1 part linseed oil meal, and 1 part corn meal. During the 54 days of the test the rams made an average daily gain of 0.54 lb., at a cost of 4.6 cts. per pound, the wethers a gain of 0.453 lb., at 5.6 cts. The value of an acre of rape with the ram lambs was \$17.97, with the wethers \$14.03.

Lamb feeding (*New Mexico Sta. Rpt. 1917, pp. 85-87*).—This experiment was made to determine whether lambs would make profitable use of weeds and other roughage that usually go to waste, and also to determine the most economical ration for finishing them for market.

Rambouillet grade lambs, 168 in number, were run for 80 days in fields containing cornstalks and weeds. Their gains during this period were small. They were then divided into four lots and fed for 60 days. Three lots were fed an average of 1 lb. of shelled corn daily and one lot 0.6 lb. All were fed alfalfa hay, but in two lots part of it was replaced by corn silage. In one lot a part of the shelled corn was replaced by corn silage.

The results indicate that it is more economical to limit the grain ration and to feed corn silage in connection with the alfalfa hay.

The agricultural situation for 1918.—I. Hog production should be increased (*U. S. Dept. Agr., Office Sec. Circ. 84 (1918), pp. 24, figs. 2*).—Attention is called to the increasing needs of pork products to meet home demands as well as those of our allies. While pork constitutes more than one-half of the meats produced in the United States it furnishes also large supplies of fat, the need for which is acute. During 1917 there was a decrease of 5,427,000 hogs, or about 7 per cent less than in 1916. The exports of pork products in 1917 were 1,417,000,000 lbs.

To meet the demands 15 per cent more hogs are needed. There was an increase in cereals during the year, much of which is available for pig feed, of 836,624,000 bu. To encourage feeding the U. S. Food Administration fixed a minimum price on hogs on the hoof at \$15.50 per 100 lbs. at the stockyards.

To further the production of pork it is recommended to preserve breeding animals, to market hogs at heavier weights, to use self-feeders, and to feed more wastes, such as city garbage. Pig clubs, swine breeders' associations, and loans to pig feeders are indorsed.

The more common diseases of the hog are explained, special attention being given to the employment of the serum treatment for hog cholera.

Swine, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1916, pp. 569-573, 577-581, 583-597, pls. 4*).—At the Central Experimental Farm an experiment was carried out to determine the best method of feeding weanling pigs 10 weeks old or over during the summer. The pigs were divided into four lots of eight or nine pigs each and the experiment continued 84 days. Lot 1 received a mixture of equal parts of shorts, ground oats, and finely ground barley, plus skim milk. Lot 2 received the same feeds as lot 1 plus all the green clover they

would clean up. Lot 3 was fed whole barley in the hopper grinder, and as much each of equal parts of shorts and oats in a grain mixture as they consumed of the barley from the hopper grinder. They also received the same quantity of skim milk as lots 1 and 2. Lot 4 was fed a grain mixture of equal parts of shorts, finely ground oats, and finely ground barley fed in a self-feeder; also skim milk as in the other lots, but separately.

Lot 1 made an average daily gain of 1.06 lbs. per head, at a cost of 3.5 cts. per pound of gain; lot 2, 1.12 lbs. daily, at 3.51 cts. per pound; lot 3, 1.12 lbs., at 4.6 cts. per pound; and lot 4, 0.999 lb., at 3.58 cts. per pound. While the results show little difference in the use of the self-feeder, the fact that it required only half the time and labor as the usual methods of feeding indicates its possibilities.

An experiment was made at the same station with litters of young pigs from the time they began to eat until they were three months old, comparing linseed oil meal and tankage, skim milk and tankage, and single meals and a mixture of two or three meals with and without skim milk. The objects of the experiment were similar to those of the previous year (E. S. R., 36, p. 68), except that corn was the basis of the ration then while barley was, for purposes of economy, the basis in the present work. The experiment continued for 84 days. Lot 1, containing 10 Yorkshire pigs, on a ration of ground barley, shorts, and oil meal, 3:3:1, plus skim milk, made an average daily gain of 0.96 lb., at a cost of 2.97 cts. per pound of gain. Lot 2, 8 Berkshires, on a similar ration, except that one part of tankage was used instead of the oil meal, gained 0.66 lb. daily, at a cost of 3.93 cts. Lot 3, 8 Yorkshires, was fed a ration of finely ground barley and tankage, 6:1, plus skim milk, and made a daily gain of 0.97 lb., at a cost of 3.41 cts., while lot 4, 9 Berkshires, on the same ration, but without the skim milk, gained 0.52 lb. daily, at a cost of 4.1 cts. Lot 5, 11 Yorkshires, on a ration of finely ground barley plus skim milk gained 0.87 lb. daily, at a cost of 3 cts. per pound.

Compared with the experiment of the previous year there was little similarity in the total gains per lot, but in cost of gains there was more concordance. In this experiment oil meal gave better results than tankage, while in the previous experiments they were practically identical. As in the previous experiment, increased gains were shown by replacing the shorts with barley. The superiority of skim milk over tankage for economical gains is indicated.

An experiment was also made at the same station to compare the palatability, the digestible economy, and the gains made by pigs fed on various meals on the basis of protein content. The work was carried out with six lots of 5 pigs each, varying from 4 to 6 months of age, and with five lots from 2 to 3.5 months of age.

In the first experiment, lasting 56 days, the pigs were fed shorts, ground barley, and skim milk. In addition lot 1 received ground corn and made an average daily gain per head of 1.1 lbs. at a cost of 4.2 cts. per pound of gain; lot 2 with gluten feed made an average daily gain of 1.19 lbs. at a cost of 3.8 cts.; lot 3 with cottonseed meal, an average daily gain of 1.26 lbs. at a cost of 2.8 cts.; lot 4 with linseed oil cake gained 1.24 lbs. daily at a cost of 3.2 cts.; lot 5 with peanut oil meal, an average daily gain of 0.8 lb. at a cost of 4.3 cts.; and lot 6 with fish meal, an average daily gain of 1.1 lbs. at 4.7 cts. per pound.

In the second test, with younger pigs, the lot on fish meal was omitted. The other five lots were fed as before. Lot 1 on ground corn gained 1.13 lbs. daily at a cost to produce of 4.2 cts.; lot 2 on gluten feed gained 1.07 lbs. at a cost of 4.2 cts.; lot 3 on cottonseed meal gained 1.17 lbs., at a cost of 3.5

cts.; lot 4 on linseed oil cake gained 1.14 lbs., at a cost of 8.7 cts.; and lot 5 on peanut oil meal gained 1.11 lbs., at a cost of 3.5 cts.

In these experiments cottonseed meal, fed in proportion of 12.5 per cent of the ration, proved safe and gave the most economical gains. Linseed meal was practically equal to cottonseed meal. Peanut meal, while low in gains, showed up well in cost, due to the small amount necessary on a protein basis. Gluten meal compared closely with corn meal. Fish meal, while palatable, caused intestinal disturbances even though fed as only one-tenth of the meal ration.

In Manitoba, barley is the accepted standard feed for pig fattening. An experiment was carried out at Brandon to test the desirability of mixing other feeds with it. Four lots of pigs were used. Lot 1, containing 5 pigs, was fed barley; lot 2, 5 pigs, barley and feed flour, 8:1; lot 3, 4 pigs, barley and shorts, 8:1; and lot 4, 4 pigs, barley and oats in equal parts. In addition each animal in all lots was fed about 0.4 lb. of tankage daily.

Lot 1 made an average daily gain per head of 1.11 lbs. at a cost of 4.44 cts. per pound of gain; lot 2 a daily gain of 1.07 lbs. at a cost of 5.07 cts.; lot 3 a daily gain of 0.99 lb. at a cost of 5.08 cts.; and lot 4 a daily gain of 0.96 lb. at a cost of 6.18 cts. The previous year barley and feed flour had given the best results. In both years the barley and oats mixture was the most expensive and least satisfactory.

As skim milk is not usually available on Manitoba farms, an experiment was also undertaken at Brandon to find a succulent feed for young pigs to be used as a substitute. Mangels and potatoes, both raw and cooked, were tried, being fed with barley chop and shorts. The raw feeds were valued at \$3 per ton and the cooked at \$5. The cooked potatoes gave the best results both in gains and costs, while the raw potatoes were least satisfactory. The cooked mangels gave better results than the raw but not enough to pay for the cooking.

In another experiment raw and cooked mangels were compared with a straight grain ration. The raw mangels were about equally successful with the grain and better than the cooked mangels. The successful use of the raw mangels compared with grain apparently depends upon the cost.

At the Lacombe station, Alta, three lots of 5 pigs each, after being weaned at about 10 weeks of age, were fed 30 days on shorts and milk, shorts, and wheat. Those on shorts and milk gained 0.786 lb. each daily, at a cost of 3.71 cts. per pound of gain; those on shorts 0.42 lb., at a cost of 4.71 cts.; and those on wheat gained 0.873 lb., at a cost of 3.21 cts. These results are based on milk at 20 cts., shorts at \$1.65, and wheat at \$1 per 100 lbs.

Another experiment was carried out to test the value of different pastures in pork production. A basic ration of shorts, wheat, and skim milk was fed at the values quoted in the previous experiment to seven lots of 5 pigs each on different kinds of pasture and in a dry pen. The lot on pasture made up of wheat, oats, and barley made an average daily gain of 0.808 lb. per head at a cost of 3.5 cts. per pound to produce, on alfalfa pasture 0.808 lb. at a cost of 3.4 cts., on rape 0.778 lb. at a cost of 3.45 cts., on oats 0.795 at 3.41 cts., on barley 0.762 lb. at 3.51 cts., on wheat 0.861 lb. at 4 cts., while those in the corn gained 0.501 lb. daily at a cost of 5.3 cts.

Rations for pigs at weaning time, L. A. WEAVER (*Missouri Sta. Bul. 151* (1917), p. 29).—Sixty-four pigs averaging 40 lbs. each were divided into eight lots, seven of which were pastured on rape and one on blue grass. They were fed different additional rations.

From the results of the experiment during 112 days there was found little difference in the efficiency of the following rations: (1) Corn, shorts, bran and tankage (4:4:1:1), (2) corn, shorts, and tankage (6:3:1), and (3) corn and tankage (9:1). Corn alone was not a well-balanced ration. Corn

and shorts, equal parts, was better than corn alone, but not equal to the above mentioned rations. Blatchford's pig meal and corn (1:2) was not as efficient as corn and skim milk (1:4). Skim milk was not so good as well-balanced grain rations with pigs on rape. The rape pasture was superior to the blue grass.

Digestion experiments with pigs, with special reference to the influence of one feed upon another, and to the individuality of pigs, H. S. GAUNLEY, W. J. CARMICHAEL, and C. I. NEWLIN (*Illinois Sta. Bul. 200, eds. (1917), pp. 41*).—An abstract of Bulletin 200 (*E. S. R., 37, p. 877*).

Mesquite beans for pig feeding (*New Mexico Sta. Rpt. 1917, pp. 77-82, fig. 11*).—Attention is called to the possibility of the greater utilization of the mesquite bean as a stock feed. The pods are sweet, and horses and cattle eat them eagerly. They should not be fed alone as they are constipating, but with wheat bran, alfalfa hay, or a succulent feed. They were not so well relished by pigs, but they were readily eaten when ground and mixed with milo maize meal, 2:1. With the milo maize worth \$1.50 per hundredweight, the ground beans are worth about 80 cts. per hundredweight.

In a second experiment two lots of four pigs each were fed for 76 days on alfalfa hay and concentrates as follows: Lot 1, ground corn and ground mesquite beans, 1:1; lot 2, ground corn alone. During the first nine weeks the ground mesquite beans were about 75 per cent as efficient as ground corn. They were more efficient in the first period of the experiment than in the latter.

The results of the two experiments indicate that mesquite beans make an economical feed when grains are high. The digging up of the bushes should be discouraged unless a more valuable plant is available that will thrive under similar conditions.

Tankage for pigs (*New Mexico Sta. Rpt. 1917, pp. 75-77*).—Three lots of 12 pigs each, averaging about 60 lbs., were fed ground corn, ground corn and packing-house tankage, and ground corn and El Paso tankage. The standard or packing-house tankage contained 62.9 per cent protein and cost \$3.60 per hundredweight, and the El Paso tankage, a local product, contained 47.7 per cent protein and cost \$2.50 per hundredweight. The tankage-fed pigs received 15 per cent of the concentrate as tankage until they averaged 100 lbs. each and after that 10 per cent. The three lots were supplied at all times with alfalfa hay.

The cost per pound of gain of the corn fed lot was 11.34 cts., of the standard-tankage lot 8.76 cts., and of the El Paso-tankage lot 8.56 cts. The lots on tankage ate more with a better appetite and sold for 10 cts. per hundredweight higher on the El Paso market.

Inheritance investigation in swine (*Kansas Sta. Rpt. 1916, p. 19*).—The results of one year's work in swine inheritance indicate that the short dish-face of the Berkshire is transmitted as a dominant sex-linked characteristic. Statistical studies demonstrated (1) that the number of pigs per litter is not correlated with any of the characteristics of form which are commonly supposed to influence it; (2) that selection of dams and sires on the basis of the size of the litter in which they are farrowed has no effect on the immediate progeny nor on the second generation; and (3) that the method of fertility inheritance is extremely obscure.

Horses, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1916, pp. 506-511, pls. 6*).—Experimental work with horses at the different stations dealt largely with the cost of rearing and keeping.

At Charlottetown, P. E. I., two colts foaled in June and July were weaned October 30. During this time they received some feed in addition to their mothers' milk. From November 1 to March 31 they were fed hay, roots, and

a variety of concentrates. The average cost of feed during the first period was 3.8 cts. per day and during the second period 12.4 cts. per day.

At Kentville, N. S., the average cost of feeding six work horses from April 1 to December 1 was 44.98 cts. per horse per day, and from December 1 to April 1, 32.52 cts.

At Cap Rouge, Que., from a summary of experiments for five years, from 1911, it is stated that idle horses can be wintered on a daily ration of 1 lb. of rough hay, 1 lb. of oat straw, and 1 lb. of roots (swedes or carrots) for each 100 lbs. of live weight. With hay at \$7, straw at \$4, and roots at \$2 per ton, a horse of average weight (1,280 lbs.) and idle can be kept for 9.5 cts. per day. At this station it was found that, while it took more feed to winter horses outside, the larger cost was more than compensated for by the continued good health of the animals in the open air.

At Lennoxville, Que., two mares were wintered on a ration of 20 lbs. of roots and 27 lbs. of hay each at a cost of 17.5 cts. per head per day, while two others were wintered on a ration of 4 lbs. of oats, 2 lbs. of bran, and 27 lbs. of hay at a cost of 21.5 cts. per day. Although the light grain ration made a little larger gain in weight than the root ration, the latter is recommended for the more economical wintering of horses.

At the Brandon, Man., experimental farm seven working horses were successfully wintered in a corral with an open shed for shelter. They were fed 4 lbs. of grain daily with straw for roughage.

At Indian Head, Sask., one lot of idle horses fed on bran and oat chop with the run of a straw stack during the day and stabled at night were wintered at a cost of 5.2 cts. per horse per day. Others fed the same ration and hay in addition, and stabled, cost 10.75 cts. per day. With light winter work the cost of keeping horses on the same ration was 26.75 cts. per head per day.

At Scott, Sask., the cost of wintering mature horses from 9 to 12 years old was 5.6 cts. per day, rising 4-year-olds, 6.8 cts., and rising 3-year-olds, 7.9 cts. The cost of feeding a pair of geldings at work during the winter was 13.9 cts. per horse per day.

At Lacombe, Alta., the horses are largely wintered in the open and fed on hay and grain at a cost of 11.47 cts. per day. The straw stack in the corral has not given as good returns as the straw stack in the open field where the horses have access to grass also.

The physiological effect upon work horses of alfalfa hay cut at different stages of growth (*Kansas Sta. Rpt. 1916, pp. 16, 17*).—A continuation of work previously noted (*E. S. R., 36, p. 171*).

The leaves of alfalfa contain from two to two and one-half times as much protein as the stems, while the latter contain two and one-half times as much crude fiber as the leaves. The loss of leaves in harvesting increases with maturity. The largest yield per acre was obtained when the alfalfa was cut while in full bloom. The percentage of ash and protein decreases as the plant matures, while the crude fiber and nitrogen-free extract increase. There was a sufficiently greater amount of protein in the alfalfa cured in the sun to more than offset the larger loss of leaves over that cured in the shade.

Corn silage as a part ration for horses of various ages, E. A. TOWNSEND and E. H. HUGHES (*Missouri Sta. Bul. 151 (1917), pp. 26, 27, fig. 1*).—Mature light mares and growing light horses were maintained 84 days on a daily ration of 5 lbs. alfalfa hay and all the silage they would eat. The four mares consumed an average of 15.11 lbs. of silage daily and lost 35 lbs. each for the feeding period. The growing horses, including yearlings and two and three year olds, consumed 15.9 lbs. silage daily and lost slightly in weight. From the results it

seems that alfalfa hay and silage make a cheap ration for horses not at work during winter.

Report from the poultry division for the year ended March 31, 1916, F. C. ELLISON ET AL. (*Canada Dept. Farms Rpts. 1916, pp. 1301-1379, pls. 16*).—A report of work with poultry carried on at 13 stations and farms located in various Provinces of the Dominion of Canada.

For several years prior to 1909 Canada exported poultry products, but from 1909 to 1914 the country not only had nothing to export but had to import both eggs and dressed poultry. In 1914 a small surplus was exported, and in 1915, following the "Patriotic Campaign for Greater Production," the exports exceeded the imports by \$1,842,858.

A farmer's poultry house is illustrated and specifications given.

A test was made to determine whether eggs could be shipped after being in the incubator long enough before shipping to show that they were fertile. Five shipments in lots of 15 were made from Ottawa to Winnipeg after the eggs had been incubated for 4, 6, 9, 11, and 12 days, but it was found that all eggs were dead upon arrival. Poultry survey work was carried on with two groups of farmers in Quebec and Ontario, and some pen records are given.

At the Kentville Station natural incubation gave a 73.1 per cent hatch of fertile eggs, while artificial incubation gave only 61 per cent. At the Napan Farm natural incubation averaged 49.1 per cent hatch, with 90.5 per cent alive at the end of the eighth week, while artificial incubation averaged 21.2 per cent with 57.4 per cent alive at the end of the eighth week.

At the Brandon Farm shipping breeding eggs was compared with shipping day-old chicks for distances of 1,000 and 1,300 miles. Better results were obtained by hatching breeding eggs at their destination than by shipping day-old chicks. At the Lacombe Station, out of 98 eggs shipped from Brandon 11 chicks were alive at one month of age, while from 50 day-old chicks only one was alive after one month. Out of 99 eggs shipped from Agassiz, there were 60 chicks alive at one month of age, while from 75 day-old chicks 64 were alive after one month.

In an experiment at Agassiz comparing early and late hatched pullets of two breeds, the cost of eggs per dozen and per pound was found slightly higher with the late hatched. In another experiment comparing Barred Rock pullets with 1-year-old-hens, the former produced eggs at a cost of 15.04 cts. per dozen, or 10.45 cts. per pound; the latter at 18.63 cts. per dozen, or 11.98 cts. per pound. With White Leghorns, the pullets produced eggs at a cost of 14.35 cts. per dozen, or 9.69 cts. per pound; as compared with 16.73 cts. per dozen, or 10.35 cts. per pound, for the 1-year-old hens. In a test to determine the length of time eggs would remain fertile after removal of the male, there was a drop beginning on the sixth day, amounting to 50 per cent on the tenth day, and reaching 16.6 per cent on the fifteenth day, after which all were infertile.

In a test of rice as a ration for young growing chicks it was found that all the birds fed on unmilled boiled rice soon became anemic and two of them died, those of a second lot fed on milled rice also became anemic and all died before the expiration of the experiment, while those on high-grade rice shorts developed the same symptoms after a somewhat longer period. Similar results followed the continued feeding of boiled whole rice to ducklings.

Preliminary report of the first year (pullet year) of the Vineland International egg-laying and breeding contest, H. R. LEWIS (*New Jersey Stat. Rpts. to Poultrymen, 6 (1918), No. 4, pp. 4*).—A progress report is given of the first year's performance at the Vineland contest.

In spite of an epidemic of chicken pox which attacked practically every pen on the contest plant during September and October, the average egg production

per bird was 161.8 eggs, or a 44.4 per cent lay. The 1,000 birds weighed 286 tons, and they produced 10.1 tons of eggs, the average weight per egg being 2.01 oz. To do this the birds consumed 41,812.1 lbs. of mash and 33,247.9 lbs. of grain, or an average consumption of 73.56 lbs. of feed per hen. With mash at \$2.70 and grain \$3 per hundredweight, the feed cost was \$2.26 per bird. It required an average of 3.9 lbs. of feed to produce 1 lb. of eggs, but in the highest producing pen, which averaged 221.2 eggs per bird, it required but 2.9 lbs. of feed to produce 1 lb. of eggs. On the basis of 45.4 cts. per dozen for brown eggs and 50.2 cts. per dozen for white eggs, the contest birds earned an average of \$6.06 each. Deducting from this the cost of feed, there was a net return per bird of \$3.80. With an additional charge of \$1.50 for labor, interest, depreciation, insurance, and other overhead charges, there was a net profit of \$2.30 per bird.

The number of eggs per bird for the different breeds was 169.7 for the Leghorns, 155 for the Plymouth Rocks, 150.6 for the Rhode Island Reds, and 144.3 for the Wyandottes. The actual returns above feed per bird varied from \$2.91 for the Plymouth Rocks to \$4.80 for the Leghorns. There were 10 hens in the contest that laid 265 or more eggs each during the year, the highest-producing hen being a White Plymouth Rock which laid 301 eggs.

Poultry experiments (*New Mexico Sta. Rpt. 1917, pp. 87-91*).—The results of a three months' feeding experiment with ground oats, shorts, bran, beef scrap, and cottonseed meal are reported. They indicate that there are possibilities in cottonseed meal as a poultry feed.

Very early hatches pay best, Mr. and Mrs. G. R. SHOUR (*Washington Sta. West. Wash. Sta. Mo. Bul., 5 (1918), No. 10, pp. 152-155*).—In three seasons' experiments at this station the early hatching of chickens gave the best returns. The scarcity of good hatching eggs early in the season is the greatest drawback. The lighting of the houses and the feeding have an influence on forcing early laying.

In 1917 the February 1 hatch consisted of 160 pullets and the April 1 hatch of 320. The cost of the former to 6 months of age was \$1.02 each and the latter \$1 each. The net profit per bird to December 1 was \$1.75 for the February hatch and 74 cts. for the April hatch.

Poultry on the farm, J. E. DOUGHERTY (*California Sta. Circ. 186 (1917), pp. 4*).—A general discussion of returns to be expected from poultry under average farm conditions in California. Suggestions as to feeds, feeding, and housing are incorporated.

### DAIRY FARMING—DAIRYING.

Dairy cattle, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1916, pp. 423-505, pls. 7*).—Corn silage was compared with a soiling crop of peas and oats as supplements to a grain mixture for summer feeding of milch cows. This test was conducted in three tri-weekly periods, during the first and third of which silage was fed and during the second peas and oats. On the peas and oats ration the 18 cows produced 7,947.5 lbs. of milk containing 300.32 lbs. of fat, and their average production during the two periods on silage was 7,744 lbs. of milk containing 304.15 lbs. of fat. However, the cost of the green feed fed was \$25.70 and of the silage an average of \$5.29.

A comparison was made of the relative value, palatability, and economy of linseed meal, cottonseed meal, gluten feed, fish meal, and peanut meal for milch cows. Mixtures of these protein feeds with bran and ground oats were fed so that the cows received the same number of pounds of protein in each period. The concentrates were supplemented with turnips, silage, and hay. In

the quantities used the cows ate each of the grain feeds very readily. The order of economy and value of these protein feeds was as follows: Linseed meal, gluten feed, cottonseed meal, peanut meal, and fish meal. The costs per ton were, respectively, \$38, \$32, \$33, \$40, and \$50. It is stated that although fish meal is too expensive for profitable feeding to dairy cattle in large quantities, it might be used to advantage in small quantities on account of its tonic effect.

In continuation of previous work (E. S. R., 36, p. 75), whole milk was compared with various grain substitutes with and without skim milk and butter-milk for raising calves to six months of age. These experiments have shown the great economy of feeding a good homemade calf meal with a dairy by-product, and indicate that buttermilk is slightly superior to skim milk as a supplement to calf meal.

The feed cost of raising 20 heifers to about 6 months of age varied from \$10.59 to \$39.12 per head; of raising 15 heifers to 12 months of age, from \$16.42 to \$48.42; and of raising 9 heifers to 24 months of age, from \$29.13 to \$47.92. In this test the most expensive gains were made where whole milk was fed during the first 5 months.

In a test of a number of proprietary fly repellents some of the repellents were fairly efficient. It is noted that where these sprays were used there was a complete absence of warbles on the cattle, whereas unsprayed cattle on adjoining pastures were heavily infested with warbles.

Further tests with five different makes of milking machines indicate that, taking good hand milking as representing 100 per cent thoroughness in milking clean, the efficiency of the machines varied from 91.59 to 87.46 per cent.

The ordinary single-jacket milk can was compared with an insulated double-jacket can for shipping milk a distance in warm weather. With milk cooled on eight days in July to an average of 38.2° F. at 6 a. m. and shipped by wagon, the average temperature 2.5 hours later at the city was 47.4° in ordinary cans and 40.1° in insulated cans.

The average cost of raising 4 Shorthorn heifers to 12 months of age, when they averaged 625 lbs. per head, was \$36.55. Two Shorthorn heifers cost to the calving period \$39.83 and \$93.21, respectively. Detailed data are given of the cost of raising a bull calf largely with skim milk during the first 6 months, as compared with one which was allowed to suckle the cow. The skim-milk calf at 320 days of age weighed 580 lbs. and had cost \$31.63, whereas the other calf at the same age weighed 775 lbs. and had cost \$78.20. In this test whole milk was valued at 4 cts. per quart and skim milk at 20 cts. per 100 lbs.

Four lots of from 3 to 4 10-week-old calves each were fed until they were 8 months of age. Lot 1 received whole milk; lot 2 skim milk with a grain mixture of oats, corn meal, and linseed meal (2:4:1); lot 3, a commercial calf meal and water; and lot 4, the same calf meal and skim milk. The average daily gains per head were 2.14, 1.82, 1.81, and 1.82 lbs. for the respective lots. With oats \$40, corn meal \$33, linseed meal \$40, calf meal \$80, whole milk \$25, skim milk \$4, silage \$2, and hay \$7 per ton, the average cost per pound of gain was 10.8, 4.05, 6.9, and 4.18 cts. for the respective lots.

In another test the cost of raising 7 dairy heifers to 6 months of age on whole milk, skim milk, grain, hay, and roots varied from \$26.88 to \$37.82.

To ascertain the proper quantities of grain to feed with hay, silage, and swedes a number of dairy cows were fed from November to March each year for three years. The animals in lot 1, which received all the meal they would clean up (averaging 1 lb. per 2.19 lbs. of milk), were fed at an average cost of \$24.43, and gave a profit of \$15.94 per cow per year. Lot 2, fed 1 lb. of meal to 4 lbs. of milk, averaged in feed cost \$17.47 and in profit \$14.79 per cow per year.



Lot 3, which received 1 lb. of meal to 8 lbs. of milk, was fed at an average cost of \$18.96 and made a profit of \$15.08 per cow per year.

The cost of raising 3 French-Canadian heifers to 18 months and 10 days when they weighed 728 lbs., averaged \$52.39 each. In another test the feed cost of raising a dairy heifer from birth to 1 year, on whole milk, skim milk, grain, roots, and hay, was \$33.46. Another heifer cost \$25.95 to feed from 1 to 2 years of age, and another \$30.02 from 2 to 3 years of age.

Five lots of from 16 to 20 cows were fed as follows: Lot 1, roots, 1 lb. per pound of milk, and timothy hay and oat straw; lot 2, peas and oats as silage and oat straw; lot 3, peas and oats, 75 per cent as silage and 25 per cent in green sheaves, and oat straw; lot 4, peas and oats silage and prairie hay (3:1) and oat straw; and lot 5, peas and oats silage and timothy hay (3:1) and oat straw. The average cost of producing 1 lb. of butter was 19.7, 16.7, 22.5, 20.4, and 22.6 cts., respectively.

A number of pure-bred Holstein heifers were raised to 7 months of age largely on skim milk, grain, roots, silage, and hay, with some whole milk during the first two months. During this time the average feed cost was \$19.65 per calf and the average daily gain 1.78 lbs.

In continuation of previous work (E. S. R., 36, p. 77) 4 lots of calves were fed as follows, in addition to a grain ration: Lot 4, whole milk; lot 5, skim milk; lot 6, linseed cake; and lot 7, a commercial calf meal. These calves made average daily gains per head of 1.91, 1.61, 0.7, and 0.77 lb. at a cost per pound of gain of 14.42, 5.49, 13.02, and 9.55 cts. It was noticed during the year that calves fed three or four times per day while young gave better returns than those fed twice per day.

In a comparison of open shed v. stable for senior yearling heifers during a long and severe winter in British Columbia those in open sheds gained 0.33 lb. and those in stable 0.6 lb. per head daily. The average feed cost per pound of gain was 27.9 and 16.4 cts. and the feed and housing cost per heifer \$18.21 and \$25.07, respectively.

Clover silage proved a valuable substitute for corn silage for dairy cows. Oat and barley straw, when it could be obtained cheaply, was an excellent form of roughage as compared with mixed hay. Field carrots produced good succulence for dairy cattle and are recommended for dairymen who can not successfully grow mangelis.

From a comparison of watering twice a day with keeping water before the stock, it is concluded that "the ad libitum system of watering dairy cattle has certain outstanding advantages over other systems, but not altogether from the point of increased production."

[Feeding experiments with dairy cows], J. J. HOOPER (*Kentucky Sta. Rpt. 1915, pt. 1, pp. 24, 25*).—A report of experiments on the feeding value of osage oranges for dairy cows has been noted from another source (E. S. R., 36, p. 374). One cow was fed 226 lbs. of osage oranges from February 4 to March 1, in addition to silage, corn meal, and bran. No effect was noted on the milk yield, taste of milk, or the yellowness of the cream. On account of a liberal protein content and the further fact that the oranges are succulent it is thought that they may become of considerable economic importance in winter feeding.

The feeding of 10 cc. of liquid cheese or butter color to another cow during February failed to increase the yellow color of the cream.

Feeding dairy cattle, R. L. SHIELDS (*South Carolina Sta. Rpt. 1917 pp. 14-16*).—A comparison was made of cottonseed meal and velvet bean meal supplemented by wheat bran, corn silage, and corn stover, for dairy cows. Two cows were fed for 56 days by the reversal method, the concentrates consisting of cottonseed meal and wheat bran (2:1) and velvet bean meal and

best bran (2:1), 1 lb. of concentrates being fed for each 3 lbs. of milk secured. The velvet bean meal was not eaten with relish at first, but after a preliminary period each cow ate all the velvet bean meal given her, though there was a variation in appetite.

No material difference was noted in the effect of the two rations on the sight of the cows. A slightly better milk flow was maintained by the cottonseed meal ration. The butter produced by the velvet bean meal ration was somewhat the softer and whiter and the grain finer. Analyses are given of the velvet bean meal and cottonseed meal used in the test.

In a comparison of linty and lintless cottonseed hulls for dairy cows no difference was noticed when the two kinds of hulls were fed in a dry condition. When the lintless hulls were thoroughly soaked in water before feeding there was a slight increase in milk flow in their favor.

Roughages for milk production, C. C. HAYDEN (*Mo. Bul. Ohio Sta.*, 2 1917, No. 12, pp. 387-390).—The importance of home-grown leguminous roughages as a means of reducing feed cost on dairy farms under present conditions is emphasized. Experiments already reported (*E. S. R.*, 32, p. 235) on the value of soy-bean and alfalfa hay for dairy cows are summarized.

[Sudan grass pasture for dairy cows] (*Neio Mexico Sta. Rpt.* 1917, pp. 71-74).—A 7-acre plot seeded April 19 to Sudan grass was divided into two parts, and after 60 days 12 cows were turned on one of the fields. After a few days it was found that 12 cows were not sufficient to catch up with the growth the pasture was making, and 8 more cows were added for 12 days. The two fields were irrigated and pastured alternately during the season, the change being made at intervals of about two weeks. Heavy rains came about the middle of October, making these fields too muddy for use, and the cows were given a small grain ration, averaging 4 lbs. per head. The 12 cows were divided into two lots, and the grain ration was alternated from one lot to the other every 30 days.

The results of this part of the experiment indicate that it does not pay to feed a grain ration to cows running on good pasture. During the four months that the cows were on pasture they gained an average of 19 lbs. per head, and gave 27,422.5 lbs. of milk, which contained 1,096.9 lbs. of milk fat. The 8 dairy and beef cows that were temporarily on the pasture gained 18 lbs. per head in 12 days. The pasture carried an average of 2 cows per acre for four months. There was no indication of poisoning by pasturing this grass in November after the frost came. The results of this test indicate that Sudan grass should prove to be a valuable supplement to permanent pastures during the summer under dry-land conditions.

Winter rations for dairy heifers, C. H. ECKLES and W. W. SWERT (*Missouri Sta. Bul.* 151 (1917), p. 36, fig. 1).—In this experiment, which has been under way for four years and has involved 50 heifers, it has been found that heifers receiving a ration of silage and timothy hay will be maintained but will make very little gain in weight during the winter. Gains much above the normal may be had by feeding liberally with concentrates, but this greatly increases the expense of raising the animals. Where summer pasture is relatively cheap and grain high the economical plan is to feed the animals a ration composed largely of roughage during the winter and to keep them in a moderate condition. Under this plan of feeding a large part of the growth is made from pasture, but the animal may be somewhat slower to mature. The most practical ration for Missouri conditions is silage and a legume hay for roughage, with a grain allowance of about 2 lbs. daily.

Unfavorable rations exert a much more pronounced effect upon the growth as represented by weight than upon the skeleton growth. Unless the rations

are rather extreme in character the rate of skeleton growth is not affected appreciably.

Influence of nutrition of heifers and age of breeding upon their subsequent development, O. H. ECKLES and W. W. SWERT (*Missouri Sta. Bul. 111*) (1917), p. 33).—A progress report of investigations upon the normal growth and protein requirements of growing animals (*E. S. R.*, 35, p. 371).

The growth records as shown by weight and height measurements in these experiments are proving of great value in connection with other investigations. The data obtained in the study of protein requirements for growth indicate that a ration in which about 15 per cent of the energy is from protein is sufficient for normal skeleton growth, but possibly a little deficient for the best standard as measured by gain in weight. Little difference has so far been noted in the efficiency of protein from skim milk as compared with protein from a mixed ration. Confirming previous results, it has been found that unfavorable conditions exert their effects much more on growth as represented by weight than on growth as represented by the development of the skeleton.

Factors influencing the composition of milk, O. H. ECKLES, L. S. PALMER, and W. W. SWERT (*Missouri Sta. Bul. 151*) (1917), pp. 33-35).—Progress reports are given on the following investigations:

I. *Cottonseed meal and cottonseed by-products* (pp. 33, 34).—Previously noted from another source (*E. S. R.*, 37, p. 72).

II. *The cause of the counteracting influence of corn silage when fed with cottonseed meal* (pp. 34, 35).—Continuing earlier work (*E. S. R.*, 37, p. 72), corn silage in the rations of two cows was replaced with alfalfa hay which had been treated with lactic acid equivalent in amount and concentration to that found in silage. The results gave substantial evidence that the lactic acid in silage is responsible for the counteracting effect which silage has on milk fat when fed with cottonseed meal. In the second experiment the silage in the rations was replaced by timothy hay treated with lactic acid. The results were entirely negative, but it is noted that great difficulty was experienced in causing the timothy hay to absorb the lactic acid. In a third experiment the effects of replacing silage with sugar were noted. Commercial glucose sirup equivalent to the glucose contained in the silage fed in the first experiment was fed before the typical silage fermentation had taken place. The amount was calculated from the acid contained in the silage. The hay fed in the sugar period was a mixture of equal parts of alfalfa and timothy. The results secured were entirely negative, except that they confirmed observations on the effects of feeding cottonseed meal. The fat constant during the period of glucose and hay showed only the effects of the cottonseed meal in the ration.

III. *Influence of condition at parturition on the composition of the milk and butter fat* (p. 35).—Only one cow was under observation in this investigation during the year (*E. S. R.*, 37, p. 172). This cow calved in July, 1916, at a slightly lower body weight than in 1915. She was continued on the same plane of protein intake with the same ration with the exception of silage, and she produced milk and milk fat of the same general composition as during the previous year. The protein averaged about 8 per cent and the milk fat slightly less than 8 per cent; the constitution of the milk fat showed a high saponification value, a high Reichert-Meisels number, and a low iodine value. After she had been in milk 90 days the protein in her ration was increased from a little more than 1 lb. to practically 2 lbs. a day. This caused a marked improvement in the physical condition, a gain in body weight, and an increase of several pounds in the milk flow. The percentage of protein in the milk

increased to 3.5 per cent and the fat to 5 per cent. The constitution of the milk fat also became normal, but this was probably not due to the change in ration, as the same change occurred in 1915 without a similar change in ration.

A study to determine the cause of gummy body commonly characteristic of butter produced in the South, noting especially the influence of various molasses on texture and flavor, R. L. SHIELDS, J. A. RAITT, and G. F. LIPSCOMB (*South Carolina Sta. Rep. 1917*, p. 16).—The results of the experiment indicate that "cottonseed meal products, if fed moderately, as they should be fed, do not produce sticky or gummy butter. . . . Cottonseed products, even if fed in limited amounts, tend to increase melting point of butter; wheat bran, peanut meal, and velvet bean meal tend to lower melting point of butter. Amount of working, richness of cream, and churning temperature have no effect on gummy quality of butter. Pasteurization of cream destroys gumminess of butter to some extent."

Stage of lactation affects milk yield, R. I. GRADY (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 12, pp. 401-406, figs. 2).—Data from the yearly milk records of 96 Jerseys and 96 Holsteins are summarized in order to show the effect of the stage of lactation on the yield and quality of milk.

During the first eight months of lactation the Jerseys decreased in milk yield from 4 to 8 per cent per month; based on the yield of previous months. The Holsteins during this period decreased from 2 to 10 per cent. The total decrease for this period was, for the Jerseys, 47 per cent in milk yield and 42 per cent in fat yield, and for the Holsteins, 49 per cent in milk yield and 47 per cent in fat yield. After the eighth month the decrease in milk flow was much more rapid, the average for both breeds being about 12 per cent per month. The fat content of the milk varied very little during the first four months of lactation. After the fourth month the percentage of fat gradually increased. The percentage of fat in the milk of the Jerseys was 15.5 per cent higher and of the Holsteins 8.1 per cent higher in the tenth month than in the first month.

To show how different cows vary in the changes that occur in milk flow, five cows of each breed that made but small changes in their milk flow from month to month were compared with five cows from each breed that varied greatly from month to month. It was found that the average monthly decrease of the persistent milkers was 3 per cent, and of the short milkers 9.8 per cent, during the first six months of the lactation period.

Marketing Wisconsin milk, B. H. HISSARD and H. E. ERDMANN (*Wisconsin Sta. Bul. 285* (1917), pp. 71, figs. 14).—In this report of a study of conditions surrounding the marketing of milk in a number of cities and towns in Wisconsin the authors discuss the consumption of milk in the State, grades of milk, health regulations affecting the marketing of milk, bases for payment to farmers, markets for Wisconsin whole milk, direct and indirect marketing, market organization among the milk producers, prices and price making, the relation of price to cost of production, and the condensed milk and powdered milk industries.

The cost of direct delivery of milk by seven producers varied from 1.27 to 2.38 cts. per quart. The average of five of these men who were retailing chiefly their own milk and selling relatively little at wholesale was 1.59 cts. per quart, while for two retailing bulk milk the cost was 1.28 cts. per quart. The cost of distribution in indirect marketing of milk varied from 1.22 to 3.61 cts. per quart. It is estimated that for moderate-sized plants the cost of preparing and distributing milk prior to the unusual rise of prices of 1916 was slightly over 2.5 cts. per quart. On the basis of 6.478 cts. per quart it is estimated that the total costs were distributed as follows: Amount paid farmer, 3.276 cts.; transportation, 0.489 ct.; handling at plant, 1.172 cts.; and delivery, 1.541 cts.

A brief report is made of an experiment in two Chicago districts, in which present methods of milk delivery were compared with a trial systematized, unified, delivery. In one of these districts, under present methods, 336 bottles of milk were delivered in 837 minutes by eight different men representing six companies. Under the unified experimental delivery this milk was delivered at the rate of 1.87 bottles a minute, or about 64 per cent of the time taken by the present system. In the other district the efficiency of the present method as compared with the trial delivery was just under 55 per cent. It is estimated that under a unified system of milk delivery only 37 per cent of the horses now used would be required. Other economies in such a delivery system are pointed out.

### VETERINARY MEDICINE.

[Report of the veterinary department], J. W. CONNAWAY, and H. G. NEWMAN (*Missouri Sta. Bul. 151 (1917), pp. 52-61*).—In continuation of hog cholera immunity studies (E. S. R., 37, p. 779) investigations were made of the duration of infectiousness of the blood of swine which have been treated by the serum-virus method. Forty-six pigs were treated with the blood taken from 9 immunized in this way, and it was found that the blood was regularly infectious for 8 days after immunization; that there was a variation in the infectiousness after the eighth day; and that the infectiousness ceased after the seventeenth day. It is thought, however, that the inoculation of larger doses of the blood would probably show the presence of active virus for a period longer than 17 days.

Studies made of the intra-vitam contamination of the blood of swine by tubercle bacilli furnish proof of the possibility of transmitting tuberculosis of the bovine type by blood inoculation from infected to other swine and to rabbits and guinea pigs, as well as from rabbit to rabbit.

In investigations of contagious abortion, 52 of 73 suspected herds of cattle were found to be infected with contagious abortion. Of the 1,471 cattle tested, 516 gave positive reactions to the abortion test and 955 negative. Tests of blood samples from 29 pure-bred brood sows in four herds in which contagious abortion was suspected showed positive reaction to the complement fixation test in 21 of the 29 tested.

Peptone-free media for routine culture work, N. S. FERRY and A. NOBLE (*Jour. Lab. and Clin. Med.*, 3 (1918), No. 5, pp. 298-300).—Trials with ten different media without peptone, part of them neutralized and part made 1 per cent acid, showed that for organisms which grow readily on standard plain agar, neutral veal or beef media without peptone can be substituted.

Serum veal agar: A dependable substitute for ascitic or blood agar, N. S. FERRY and A. NOBLE (*Jour. Lab. and Clin. Med.*, 3 (1918), No. 5, pp. 295-297).—The authors have found that ascitic or blood agar may be successfully replaced in most cases by a veal agar (neutral to phenolphthalein) to which has been added normal horse serum. A formula for the medium is given.

[The Abderhalden blood test], L. R. HIMMELREICHER and W. S. ANDERSON (*Kentucky Sta. Rpt. 1915, pt. 1, pp. 25, 30, 31*).—The Abderhalden blood test was made on a number of brood mares and it was found that pregnancy can be determined in 80 cases out of 100. It is believed that with more experience the test will become almost infallible.

Owing to the fact that dialyzers could not be obtained, a modification of the original method was employed, the serum proteins being precipitated out by chemical means as follows: The placental protein and serum were placed in a test tube covered with toluol and incubated for 16 hours. The contents of the

he were then filtered and treated successively with dilute acetic acid, ammonium hydroxide, and a saturated solution of ammonium sulphate, filtering after the addition of each reagent. The final filtrate was tested with 0.2 cc. of 1 per cent solution of triketohydrinden hydrate.

*Rhus glabra* as a poisonous plant, C. D. MARSH and A. B. LAWSON (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 13, pp. 699-713, pl. 4).—The authors here report upon feeding experiments in Illinois and at Washington, D. C., with the plant commonly called snakeroot and also known as richweed.

The results substantiate those obtained by Curtis and Wolf (*E. S. R.*, 37, 383), and show conclusively that it is toxic for cattle and sheep as well as other animals, producing a definite line of symptoms bearing close resemblance to those characteristic of the disease known as milk sickness, trembles, etc. The authors conclude that probably many, possibly most, cases of trembles in cattle and sheep are due to poisoning by this plant. It is stated, however, that under the term "milk sickness" or "trembles" are probably grouped at least two distinct affections, one poisoning by *E. urticifolium* and the other a bacterial disease.

A list of 14 references to the literature is included.

Gossypol, the toxic substance in cotton seed, W. A. WITHERS and F. E. MASTERS (*U. S. Dept. Agr., Jour. Agr. Research*, 12 (1918), No. 2, pp. 83-102, pl. 1, figs. 3).—In continuation of investigations previously reported (*E. S. R.*, 34, p. 381) the authors present the results of comparative experiments with an isolated and purified gossypol fed to various animals. The results have led to the following summary:

"Raw cottonseed kernels contain about 0.8 per cent of gossypol and are highly toxic to rats. Ether extraction renders the material nontoxic and gives a highly toxic extract containing about 2 per cent of gossypol. Gossypol fed in milk diets in amounts equivalent to those contained in the raw cottonseed diets has proved as toxic as raw cottonseed. Gossypol may be quantitatively removed from the ether extract by precipitation as its insoluble anillin compound. The extract is thus rendered nontoxic to rats. The insoluble anillin compound of gossypol is not toxic because of its insolubility. Gossypol prepared from this compound possesses its original toxic properties.

"Cottonseed meal is much less toxic than raw cotton seed, owing mainly to the oxidation of gossypol during cooking. Cottonseed meal, ether-extracted cotton seed, and gossypol have been fed to small pigs in pens under comparable conditions. Cottonseed meal has been found definitely injurious, while the ether-extracted raw seed does not appear to cause cottonseed-meal poisoning. Gossypol has been found toxic to pigs.

"If the presence of an injurious substance in the meal is disregarded, a diet of cottonseed meal and corn meal has nutritive limitations which may, under restricted conditions of living, lead to failure of pigs to thrive. Such failure is a phenomenon distinct from cottonseed-meal poisoning.

"Outdoor exercise, access to forage and soil, and improved diets tend to postpone or avert cottonseed-meal poisoning of swine. The deficiency hypothesis that cottonseed-meal poisoning of swine is similar to beriberi is untenable."

A list of 19 references to the literature cited is appended.

The solvent action of antiseptics on necrotic tissue, H. D. TAYLOR and J. R. AUSTIN (*Jour. Expt. Med.*, 27 (1918), No. 1, pp. 155-164, pl. 1).—The solvent action of Dakin's solution on necrotic tissues was compared with that of other chlorinated antiseptics, including chloramin-T, dichloramin-T, and chlorinated paraffin oil and eucalyptol, by adding 50 cc. of each solution to 5 cc. of an emulsion of macerated liver tissue, shaking the mixture thoroughly

every half hour for two hours, and measuring the amount of sediment remaining after centrifugation. From the experimental data obtained the following conclusions were drawn:

Dakin's hypochlorite solution has the power of dissolving necrotic tissue, pus, and plasma clot in the concentration and reaction used clinically, but other antiseptics tested do not show this action. The solvent action of Dakin's solution is due primarily to its hypochlorite content, but its slight alkalinity increases the effectiveness of the hypochlorite. The hypochlorite concentration at which the solvent action ceases is lower the more alkaline the solution, and in the degree of alkalinity used clinically the minimum concentration for solvent action is about 0.2 per cent. None of the antiseptics studied has a solvent action on blood clot.

These results do not support the clinical observations of Sweet (E. S. R., 7, p. 878) and others that the more recent and more stable chloramins are more effective in dissolving dead tissues than the older chlorin compounds. The greater solvent action of Dakin's solution the author assumes to be due to its greater lability.

Methods of controlling blackleg developed by the Kansas State Agricultural College, L. W. Goss (*Kansas Sta. Rpt. 1918*, pp. 44-49).—As a result of investigations continuing those previously noted (E. S. R., 36, pp. 149, 150), "a serum has been produced from the horse which will stop immediate losses in a herd in which calves are dying from blackleg. Also, a germ-free fluid vaccine or aggressin has been produced from calves, which when given upon healthy calves will produce a more durable immunity against blackleg."

The serum is prepared by five successive injections, from 7 to 10 days apart, of pure cultures of *Bacillus chauvæi* into the jugular vein of a horse. Seven days after the last injection a sample of blood is drawn and 0.55 cc. of the clear serum injected subcutaneously into each of three guinea pigs which 15 hours later injected subcutaneously with 125 mg. of dried muscle from blackleg lesion of a calf. If the test is satisfactory the horse is bled upon the third day and the clear serum bottled after the addition of 0.5 per cent phenol. The serum produces only a passive immunity, but active immunity may be acquired by following the serum inoculation in three days with from 2 to 8 mg. of a virus made from the darkest meat of a blackleg lesion of a calf. This is ground, passed through an 80-mesh sieve, and made into pellets which are then attenuated at 60° C. for an hour to kill nonspore-forming organisms.

The germ-free fluid vaccine or aggressin is made by the inoculation of calves with muscle virus in doses of 1 gm. or by the use of from 20 to 30 cc. of pure cultures of *B. chauvæi*. After the death of the calf the affected tissue is removed, ground, frozen, thawed, and filtered through infusorial earth filters. The filtrate is sterilized with 0.5 per cent of phenol or 1 per cent of chloroform and tested for potency and sterility by subcutaneous inoculation of guinea pigs with 10 cc. of the vaccine.

The blackleg serum is curative in the early stages of the disease and will check outbreaks within 12 to 24 hours. The germ-free vaccine will not check blackleg but will produce immunity within four or five days after inoculation. This immunity is of longer duration than that produced by the powder or pellet form of vaccine. It is advised that "serum should be used upon animals with symptoms of blackleg. Serum and pellets should be used upon herds in which losses are occurring at the time of vaccination. Germ-free fluid vaccine should be used as an annual vaccination upon calves at weaning time or earlier, should conditions indicate necessity."

The eradication of tuberculosis from cattle and swine, J. A. KIRBY (*Amer. Jour. Vet. Med.*, 13 (1918), No. 1, pp. 1-7).—A paper presented at the

...fifth annual meeting of the Illinois Veterinary Medical Association at Chicago, in December, 1917, in which the author outlines some proposed plans for the eradication of tuberculosis from cattle and swine.

**The struggle against bovine tuberculosis.** A. GRANU (*Vie Agr. et Rurale*, 1918, No. 9, pp. 155-157, fig. 1).—The author emphasizes the necessity of vigilance against bovine tuberculosis, and describes a French organization for its control having as its aims (1) to combat by the tuberculin test the propagation of bovine tuberculosis in the stables as far as possible, (2) to safeguard and defend the interests of the members in a contested case, and (3) to indemnify the members of the society in case of loss caused by the death or capture of a tubercular animal.

**Control of tuberculosis and infectious abortion.** V. A. MOORE (*N. Y. Dept. Agr. Bul.* 94 (1917), pp. 25-33).—The history and nature of bovine tuberculosis are discussed and requirements necessary in a successful campaign for its suppression suggested. The author states that much more research will have to be done before definite successful methods of control of infectious abortion can be established, but that the provisional method of prophylactic treatment consisting of douches and disinfection should be carried out.

**Papulum notatum, the cause of a new disease of cattle.** F. ROSENBUCH and J. ZABALA (*An. Soc. Rural Argentina*, 51 (1917), No. 3, pp. 245-248, pl. 1).—This is a report upon a disease of cattle which occurs in the Provinces of Buenos Aires and Santa Fé, Argentina, and is characterized by generalized muscular trembling and debility. It is known as "tembleque" or "chucho."

**Concerning "pasto dulce" and the disease which it causes in cattle.** L. ROMAN (*An. Soc. Rural Argentina*, 51 (1917), No. 5, pp. 379, 380).—The author gives exception to the identity of the plant reported as the cause of a new disease in cattle in the paper noted above.

**"El gramillón" or "pasto dulce," the cause of "tembleque,"** F. ROSENBUCH and J. ZABALA (*An. Soc. Rural Argentina*, 51 (1917), No. 5, pp. 380-381).—A further discussion of this subject.

**Renguera, a paralytic sheep disease in Peru.** S. H. GAIGER (*Jour. Compar. Med. and Ther.*, 30 (1917), No. 3, pp. 185-209, figs. 4).—"Renguera is a new and hitherto undescribed disease of lambs, occurring in the Peruvian Andes. Sheep only appear to be susceptible. Renguera belongs to the class of nervous diseases to which louping-ill, scrapie, and swing-back in Britain, and pataleta in South America belong. Renguera is distinguishable from louping-ill by its affecting lambs only and by there being no convulsions in any form of the disease. From scrapie it is distinguished by there being no symptoms of skin irritation. Owing to insufficient knowledge of swing-back, it is not at present possible to compare that disease with renguera. Renguera agrees closely with some of the descriptions of pataleta in Argentina, but not with other descriptions. Renguera is almost constantly associated with a micrococcus, which can be grown from the fluids and tissues of the body, including sometimes the brain and spinal fluid, but in the absence of success in all attempts to transmit the disease, either with this coccus or with any of the fluids and tissues of the body. It is not possible yet to say if this coccus is the casual agent.

Curative measures hold out little promise of success. Preventive measures may be found in course of time from experiments in this direction which are now being carried out by those on the spot. The occurrence of this disease at an altitude where ticks do not exist should be of special interest to those concerned with sheep diseases in Britain, as it shows that ticks are unnecessary for the propagation of at least one sheep disease of the nervous type."

This report is based upon investigations made in Peru, following the author's arrival there in August, 1916.



**Znootic paraplegia in sheep.** M. E. TARUSSO (*Clin. Vet. [Milan]. Rass. Sanit. e Ig.*, 40 (1917), No. 16, pp. 457-472, fig. 1; *obs. in Trop. Vet. Bul.* (1917), No. 4, pp. 269-273).—This is a report of studies of the disease in lambs occurring in the Peruvian Andes referred to as *renguera* by Gaiger in the report of investigations noted above, and also known as *pataleta*, *tumbalaga*, *vertigo*, and *chucho*.

**Experimental studies in hog cholera.** R. A. CRAIG and R. A. WILSON, (*Indiana Sta. Bul.* 204 (1917), pp. 3-12, fig. 1).—This is a report upon the microscopic and cultural examinations made of blood and other virulent material from cholera hogs and inoculation and blood attenuation experiments.

The studies have shown that while *Bacillus suispestifer*, *B. suiscepheus*, *B. coli* and diplococci may be present in the blood and tissues of cholera hogs these present may not be the same in different outbreaks of the disease. *B. suispestifer* is usually met with and *B. coli* is not uncommonly present in highly virulent strains of blood.

In order to prevent blood used for virus from losing its virulence and avoid losses from septicemia in the hyperimmunes, it has been found necessary to inoculate pigs a few weeks old with filtered hog cholera blood and use their blood for inoculating the hogs used for producing virus. Since there is danger of stock virus losing its virulence if every generation is filtered, the usual practice is to filter every second generation of blood used for inoculating young pigs.

In filtration and blood examination work more than 500 bacteria-free filtrates, mostly blood and virulent salt solution from cholera hogs, were studied, the different filters being used. It was found by inoculation tests that the filtrable virus did not uniformly pass through Pasteur-Chamberland filter B. It was noted that where filtration took place very slowly, extending over a period of several hours, and a vacuum maintained, the bacteria would pass through the different filters used.

An experiment undertaken for the purpose of determining the character of the hog cholera lesions produced by the filtrable virus is briefly reported upon. Hog cholera blood and blood filtrate inoculation experiments in which pigs from nonimmune mothers and weighing from 40 to 60 lbs. were inoculated with hog cholera blood and blood filtrates from virus hogs from 4 to 8 days following inoculation are reported upon in tabular form. The controls showed infection in from 4 to 10 days after one or more of the inoculated pigs developed a temperature of 104° F. The pigs inoculated with the 7- and 8-day virus did not live so long as those receiving 4-, 5-, and 6-day virus. It appears that 8-day virus is no more virulent than 4-day and less virulent than 6-day virus.

In determining the effect of heat hog cholera blood was heated in a water bath for different periods, ranging from 30 minutes to 2 hours, and at different temperatures. One lot of virus heated to 57° C. and three lots heated to from 51 to 53° for 2 hours produced the acute form of hog cholera in pigs that were inoculated with them. Virulent salt solution heated to from 55 to 60° in a water bath for 1 hour produced hog cholera in pigs inoculated with it.

Hog cholera blood to which normal salt solution had been added in the proportion of 1: 2 was incubated for from 21 to 72 hours at 36.5° and afterward heated 1 hour in a water bath at 60°, after which a 0.5 per cent phenol solution was added. Several lots of pigs were inoculated with 2 cc. each, and with some repeated in 5 days, but none reacted and all contracted hog cholera when exposed 2 to 3 weeks later.

Different proportions of hog cholera blood and antihog cholera serum were mixed and kept in a refrigerator for one day, then heated to 60° in a water bath for 1 hour, and 0.5 per cent phenol added. Tests upon pigs showed the

virus to have been destroyed and all contracted hog cholera on exposure. Experiments indicate that hog cholera blood to which 0.75 per cent carbolic acid has been added for 19 days or longer loses its virulence, as was shown by a longer incubation period, the percentage of recoveries, and the slowing up of the symptoms of the disease.

Experiments with desiccated hog cholera blood demonstrate that the virus is not be attenuated by the methods practiced, and that desiccated blood exposed to daylight and room temperature is usually destroyed within a short time.

Work with sensitized virus indicates that it is possible to immunize hogs against the disease in this way. Inoculation experiments with filtrates made from rabbits show that the filtrable virus maintains its virulence for this animal for a period of 7 days, but when passed through two rabbits it does not produce a typical hog cholera temperature reaction.

Notes on parasitic anaphylaxis and allergy, L. VAN ES and A. F. SCHALK (*North Dakota Sta. Bul. 125 (1917), pp. 151-193, pls. 2, fig. 1*).—The conclusion of the Seyderheims (E. S. R., 35, p. 80) that infectious anemia of the horse is caused by a toxic substance obtained from *Gastrophilus* larvæ led the authors to conduct the investigations here reported in detail. In addition to experiments with *Gastrophilus* larvæ, which take up the greater part of the work, experiments were also carried on with *Ascaris megaloccephala*, *Trichostrongylus axei*, *Toxascaris limbata*, *Belascaris marginata*, *Dipylidium caninum*, *Tenia serrata*, *Gyropus ovalis*, and *G. porcelli*.

The results obtained have led to the following conclusions: "There is no reason to believe that *Gastrophilus* spp. play a specific part in the causation of infectious anemia or awamp fever of the horse. The severe intoxication following the injection of *Gastrophilus* material into horses is not due to a special substance in the sense of the 'oestrin' of the Seyderheims. Such intoxications are purely a manifestation of anaphylaxis and in no way differ from those precipitated by the use of any foreign protein. Many parasitic species sensitize their hosts, who upon reinjection will respond by anaphylactic or allergic reactions. The acutely toxic properties thus far found to be associated with parasites owe their toxicity to the specific sensitization of the animals injected with materials of parasitic origin. It is reasonable to assume that anaphylactically intoxicating substances of parasitic origin can gain entrance into the body through the same channels which previously served for the entrance of the sensitizing ones. By a more or less constant presence of certain parasites the body may be constantly supplied by parasitic anaphylactins. It is within the range of possibility that such a form of intoxication may give rise to certain more or less definite disease processes."

On the treatment of lymphangitis in the horse, CHAUSSÉK (*Rev. Gén. Méd. Vet.*, 27 (1918), No. 313, pp. 12-14).—The author describes a method of cauterization in the treatment of lymphangitis and emphasizes the importance of applying this treatment at the first indication of the disease.

Bacillary white diarrhea, A. G. LUKK (*Jour. Mass. Poultry Soc.*, 1 (1917), No. 2, pp. 13-15).—This is a summary of information.

## RURAL ENGINEERING.

Second report of the State engineer of New Mexico, J. A. FRENCH (*Rpt. State Engin. N. Mex.*, 2 (1914-1916), pp. 103, pls. 30).—This report deals with the work and expenditures of the office of the State engineer of New Mexico, especially on roads and bridges, irrigation, and river protection for the period

from December 1, 1914, to November 30, 1916, and continuing previous work (E. S. R., 36, p. 284).

**Land drainage: Some notes on open draining and points in pipe drainage.** L. J. B. GRANT and A. J. FAULKNER (*Jour. Agr. [New Zeal.], 15 (1917), No. 2, pp. 91-95, figs. 5*).—Brief notes on open surface drains and on subsurface pipe drains for New Zealand conditions are given.

**Tile drainage for the farm.** H. B. WALKER (*Bien. Rpt. Kans. Bd. Agr., 1915-16, pp. 152-169, figs. 12*).—This is a brief discussion of tile drainage, with special reference to Kansas farms.

**The subsidence of muck and peat soils in southern Louisiana and Florida.** C. W. OKEY (*Proc. Amer. Soc. Civ. Engin., 43 (1917), No. 7, pp. 1499-1522, pls. 1, figs. 18*).—The object of this paper is to call attention to the fact that in designing drainage improvements it is often necessary to anticipate the subsidence of muck and peat lands subsequent to drainage. The results of some observations made in England on the subsidence of drained muck and peat lands are reviewed, and the results of first-hand observations made in Louisiana and Florida are reported in detail graphically.

"It is clearly evident that in planning drainage improvements for areas of deep muck land, some provision should be made for the gradual but certain decrease in elevation of the surface. In relatively small districts, where drainage is secured by pumps, this decrease can be met easily by lengthening the suction pipes on the pumps. As the drainage channels in such soft lands require considerable maintenance in the earlier years of drainage, they can be deepened accordingly. Where the land is drained by gravity, the elevation of the water at the outlet is usually fixed, and a change in elevation of the land to be drained will mean a revision of the hydraulic gradient in the main drainage channels, with the consequent change in width and depth of the channels."

**Leveling of old battle fields.** M. RINGELMANN (*Jour. Agr. Prat., n. ser., 9 (1917), No. 10, pp. 178-180, figs. 2*).—Methods and machinery for leveling battle fields in France and preparing them for cultivation are described.

**Surface water supply of New Mexico, 1916.** J. A. FRENCH (*Santa Fe, N. Mex.: State Engin. Dept., 1916, pp. 146*).—This report presents the results of measurements of flow made on the Canadian, Gila, Mimbres, Pecos, Rio Grande, Rio Tularosa, San Francisco, and San Juan River Basins and in Estancia Valley, N. Mex., for 1916, continuing previous work (E. S. R., 37, p. 381).

**[Ground water studies in the Rio Grande and Socorro Valleys] (New Mexico Sta. Rpt. 1917, pp. 31-43, figs. 4).**—Preliminary observations are reported, together with maps and curves showing the behavior of the water table.

**Surface waters of Vermont.** C. H. PIERCE (*U. S. Geol. Survey, Water-Supply Paper 424 (1917), pp. 218, pls. 10, figs. 2, maps 4*).—This report, prepared in cooperation with the State of Vermont, describes the general features and gives the results of flow measurements made on streams in the St. Lawrence and Connecticut River Basins of Vermont. A gazetteer of the streams of the State is appended.

**Analyses of mineral and potable waters.** A. M. PETER, S. D. AVERITT, and J. S. MCHARGUE (*Kentucky Sta. Rpt. 1915, pt. 1, pp. 49-72*).—Analyses of 55 samples of potable and mineral waters from 29 counties in Kentucky are reported.

**Mineral springs of Alaska.** G. A. WARING (*U. S. Geol. Survey, Water-Supply Paper 418 (1917), pp. 114, pls. 6, figs. 16, maps 3*).—This report deals with the mineral springs of Alaska, with particular reference to their hygienic value.

a chapter on the chemical character of some surface waters of Alaska, by E. B. Dole and A. A. Chambers, is included.

The few analyses available show a favorable condition of the surface waters. They indicate that the streams in general yield supplies moderate in mineral content, low in chlorid and sulphate, and essentially calcium carbonate in character. All the supplies tested are low enough in mineral matter to be useful for domestic and industrial use, and they resemble in composition the most mineralized waters of the United States."

Well waters from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rep. 1916*, pp. 180-185).—Analyses of 173 samples of Canada farm water supplies reported show that 22 per cent were pure and wholesome, 24 suspicious and probably dangerous, 32 seriously polluted, and 22 per cent too saline to be potable.

Removing the taste due to algae in drinking water, A. C. HUSTON (*Brit. Med. Jour.*, 2919 (1916), pp. 816, 817; *Pharm. Jour. [London]*, 4, ser., 98 (1917), p. 139; obs. in *Jour. Soc. Chem. Indus.*, 36 (1917), No. 4, p. 232).—"Potassium permanganate, added in quantities of 2.5 to 5 lbs. per million gallons, proved much more effective than hypochlorites in removing the nauseous taint due to the growth of algae in reservoirs. . . . The use of hypochlorites involves the risk of merely replacing one taste by another or even of introducing a super-added taste."

The activated sludge process of sewage treatment: A bibliography of the subject, J. E. PORTER (Rochester, N. Y.: General Filtration Co., Inc., 1917, pp. 40). This is a bibliography of the subject with brief abstracts, patents, news items, etc., compiled from current literature.

A preliminary report on blended Portland cement, E. S. McCANNLISSE (*Bul. School Mines and Metallurg., Univ. Missouri, tech. ser.*, 3 (1917), No. 3, pp. 11-13, fig. 22).—Experiments are reported from which the conclusions are drawn that "Portland cements of a fineness sufficient to pass a No. 200 sieve may be blended as much as 40 per cent, by weight, with quartz sand, the latter of a fineness sufficient to pass a No. 65 sieve, but not fine enough to permit of more than 20 per cent to pass a No. 200 sieve, and the resulting blended cement will satisfactorily pass the requirements of the present standard specifications for Portland cement of the American Society for Testing Materials. Quartz sand is a satisfactory substitute for the inert clinker particles in Portland cement in maintaining the present physical characteristics of the latter, when used in amounts not to exceed 30 per cent, by weight."

The effect of sulphid on cement, J. C. WITT (*Philippine Jour. Sci., Sect. A*, 11 (1916), No. 6, pp. 273-290, pl. 1, fig. 1).—Experiments on the influence of a sulphid solution on the properties of cement are reported.

It was found that the time of setting is greatly modified by the presence of sodium sulphid, being retarded by the low concentrations, but after reaching a maximum further additions accelerate the set. In general, the cements highest in iron were the most sensitive to this influence.

There is a decided decrease in tensile strength. The percentage loss varies with the concentration of the sulphid and with the iron content of the cement. The briquettes appear normal in every other respect, except in color. There is no cracking nor distortion of any sort. In most cases sulphid may be present in concentrations up to 1 gm. per liter without causing the tensile strength to fall below United States Government specifications. Certain results indicate that a colloid is formed by the action of sodium sulphid on the iron in the cement. Based on the results of both chemical and physical observations, the following explanations of the decrease in tensile strength are offered: (1) The precipitated colloid forms films of inert material through the cement and inter-

feres with the cohesion. (2) When the colloid is precipitated a portion of the dissolved calcium hydroxid is removed from solution. Since the latter substance is a very important factor in the strength of cement, it is to be anticipated that the strength will be lowered when some of it is removed.

"It is probable that a number of other factors influence the effect of silica on cement. Among these may be mentioned the fineness of the cement, the temperature at which it is mixed, the percentage of water used, and the amount of dissolved calcium hydroxid."

**Asphalt, related bitumens, and bituminous rock in 1916, J. D. Norcross (U. S. Geol. Survey, Min. Resources U. S., 1915, pt. 2, pp. 11+263-281).**—This report discusses the occurrence, distribution, and production of asphalt and related bitumens, and states that "the quantity of natural asphalt, including bituminous rock, grahamite, gilsonite, wurtzilite, and the native paraffins, ozokerite, produced and sold at mines and quarries in the United States in 1916 was 98,477 short tons. This quantity was greater by 22,726 tons, or 30 percent, than the output in 1915." Data on imports and exports are also included.

**Investigations of gravel for road surfacing, T. R. Aog (Iowa Engin. Expt. Sta. Bul. 45 (1916), pp. 32, figs. 23).**—Investigations are reported, the purpose of which was to determine in a general way the character of the road building gravels in the State of Iowa, to establish construction and maintenance methods adapted to Iowa conditions, and to determine the possibilities of the use of bituminous materials for the construction and maintenance of gravel roads. Analyses of 151 Iowa gravels show that they do not contain as great a percentage of pebbles as is desirable in road surfacing material and not sufficient clay to serve as a permanent binder, "yet the gravels do bind in time, showing that some other element in the gravel is a factor in the bonding action."

Experiments on methods of construction are also described, in which seven sections of road with gravel surfaces were constructed by the two-course trench method, the single-course trench method, and as a single-course surface placed on top of the earth road. A road was also constructed of river gravel.

Experiments on the use of bituminous coatings on concrete surfaces are also described. In one case it has been found possible to maintain concrete roads in good condition by this method at a cost of not to exceed 2 cts. per square yard per year. Further experiments showed "that only a very few materials can be used for carpet coats on concrete and that they must be applied with extreme care or they will peel off the surface."

Experiments along this line in other States are reviewed and the conclusion drawn that "the service value of a well-built gravel road is so much greater than of the poorly built roads that it far outweighs the relatively small difference in cost. It is especially clear that it does not pay to skimp the materials and it is an extravagance to construct a good road and then fail to keep it in good repair. Gravel roads deteriorate very rapidly if neglected."

**Labor-saving machinery, C. I. GUNNESS (Mass. Agr. Col. Ext. Serv. Cir. 42 (1917), pp. 4, figs. 6).**—The purpose of this circular is to call attention to the machines which can be used to advantage in the raising of potatoes, corn, beans, and other garden crops, and when possible to indicate the size of plants which can be most profitably used.

**Buying a farm tractor, W. H. SANDERS (Blen. Rpt. Kans. Bd. Agr. 20 (1915-16), pp. 123-145, figs. 18).**—This is a review of the main factors influencing the selection and purchase of a tractor for a Kansas farm, including relative economy, first cost, depreciation, repairs, tractor types and speed, motor styles, fuel, lubrication, and size and power ratings. The use of the tractor on special kinds of work is also briefly discussed.

**Tractors and their use in Mexico**, R. CHÁVEZ (*Rev. Agr. [Mex.], 1 (1917),* pp. 17-20, pls. 5).—A brief note on the use to which tractors may be put in Mexican agriculture.

**Farm storage of grain**, C. P. BUCK (*Bien. Rpt. Kans. Bd. Agr., 20 (1915-16),* pp. 145-151, figs. 4).—This is a brief discussion of portable and stationary grain storages and grain elevators for use on Kansas farms.

**Farm manure and its housing**, B. G. SOUTHWICK and F. W. DUFFY (*Conn. Agr. Col. Ext. Serv. Bul. 5 (1917),* pp. 22, figs. 7).—The purpose of this bulletin is to draw attention to the value of farm manures and to emphasize the economic importance of their proper care and housing. Plans for manure pits and other equipment for manure conservation are included.

**Lambing sheds**, R. F. MILLER and G. E. FERNBERY (*California Sta. Circ. 183 (1917),* pp. 16, figs. 13).—Illustrated descriptions are given for a lambing barn, an open-front lambing shed, movable lambing pens, and sheltered lambing pens and corrals.

## RURAL ECONOMICS.

**Important factors for successful farming in the blue grass region of Kentucky**, J. H. ARNOLD and W. D. NICHOLS (*Kentucky Sta. Bul., 210 (1917),* pp. 171-206, figs. 7).—This bulletin contains additional data with reference to farms located in Mason, Scott, and Madison Counties, Ky., as previously noted (*E. S. R., 36, p. 780*).

The authors point out that the type of farming that should be followed in this community depends upon "the amount of land available, the topography, the quality of the land, and accessibility to market. The most general type suited to conditions in the blue-grass region is the stock with tobacco type. This type combines stock grazing, an enterprise characteristic of the most extensive type of farming, and tobacco culture, one of the most intensive enterprises, in such a way as to make the most profitable use of the land. It should be remembered in this connection that the farmer who keeps a large percentage of his acreage in blue grass for grazing of live stock will have better lands for tobacco raising, and that lands which have the best blue grass sods raise the best quality of tobacco. Blue grass is specially adapted to the soil and furnishes a nutritious food for fattening cattle, and at the same time it prevents erosion of the soil and keeps up its fertility; while an intensive crop like tobacco enables the farmer to get large returns per acre. Such a system enables the farmer here to make about as much off of a given area of high-priced land as is secured in other good agricultural sections where land is cheaper. A small farm can often be made profitable by intensifying more than is usually done, with tobacco or by dairying."

The authors illustrate their conclusions by citing data obtained from a number of representative farms from each type.

**Farm management investigations in Missouri**, R. M. GREEN and O. R. JOHNSON (*Missouri Sta. Bul. 151 (1917),* pp. 44, 45).—These pages report preliminary results with reference to the average cost of keeping horses on farms during the year 1912-1915, inclusive.

The average cost was \$90.33 per annum. The horses appreciated in value through the sixth year, and the average cost of feeding made up 72 per cent of the total cost of keep. On the 20 farms with the lowest feeding cost per head 30 per cent fed oats with corn in equal or larger proportion, while on the 18 farms with the highest feed cost per head 61 per cent used the large proportions of oats. For the economical management of horse labor the study indicated that the horse should work 800 to 1,500 hours a year. The average cost per hour of horse labor for 1912, 1913, and 1915 was 7.6, 8.2, 7.2, and

7.6 cts., respectively. The difference between the lowest and highest average feed cost per hour of horse labor was 4 cts.

**Agriculture of the Hidatsa Indians.**—An Indian interpretation, G. L. WILSON (*Univ. Minn., Studies Soc. Sci.*, No. 9 (1917), pp. X+129, pls. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40).—This study is based on the narrative of an Indian woman, and contains information regarding the methods of laying out the garden, crops raised, methods of selecting seed, cultivating crops, tools used, storage for winter use, and the influence of the white man upon their system of agriculture.

**[Social and educational surveys of Lancaster community, Kentucky.]** C. D. BOMANNAN (*Kentucky Sta. Rpt.*, 28 (1915), pt. 1, pp. 10-12).—This survey has as its purpose the extension of the relations existing between city and country, and to formulate a plan for community development based on the actual needs of the community. It points out that for sincere development there must be hearty cooperation. While country schools are on a par with those of any other community, there is too large a dropping out of school between the first and eighth grades. There is need for improvement in housing conditions among the poorer classes, both owner and tenant. Irrigation of a cultivated crop on hillsides subject to erosion alfalfa is suggested. It recommends the admission of farmers as well as city men to membership in the Lancaster Commercial Clubs and the installation in the high schools of a department of agriculture and home science, with a short course during the winter months for older boys and girls.

**The farmhouse in relation to food supply and labor problems, Massachusetts.** (Jour. Bath and West and South. Counties Soc., 5, ser., 11 (1916-17), pp. 161, 162).—The author points out that it is the function of the farmhouse to be attractive and efficient, in order to maintain the necessary number of people in the rural community.

**The national food supply in peace and war, T. B. WOOD (Cambridge, England: Univ. Press, 1917, pp. 43).**—The author believes that in order to secure the necessary food supply for Great Britain "the policy which should be adopted must be based on five general principles: (1) It must secure the maximum amount of food for human consumption. (2) It must be sufficiently simple to be put into actual practice. (3) It must avoid dislocation of the ordinary channels of distribution. (4) It must remove temptation from the farmer, by making agricultural products which can be dispensed with as remunerative than those which are indispensable. (5) It must be enforced by penalties so heavy that no one dare risk them."

He also believes that these plans could be given effect, first by the publication of an order forbidding the use of potatoes and cereals for feeding live stock or for any other purpose than for human food; second, that in order that distribution may be continued through ordinary channels, there must be a certain elasticity in price which will allow distributing agents to make sufficient profit to maintain their normal efficiency.

**Appeal for mobilization of agricultural products, G. BRUNNELLI (Agr. 11-4 Milan, 23 (1917), No. 18, pp. 237, 238).**—The author recommends the establishment of an Italian national committee with subsidiary local committees to supervise propaganda, provide fertilizers, aid in the requisition of agricultural products for military purposes, and obtain the services of scientific institutions in giving necessary advice regarding regional products and the national program.

**Wheat dockage on a percentage basis, E. D. DAVIS (Minneapolis, Minn.: Author, 1917, pp. 48).**—This pamphlet contains tables designed to facilitate the figuring of dockage and net weights on wheat when the dockage is computed on a percentage basis.

**Monthly crop report** (*U. S. Dept. Agr., Mo. Crop Rpt., 4* (1918), No. 1, pp. 1-12).—This number contains the usual monthly data with reference to the estimated value of important farm products, average prices received by producers, and range of prices of agricultural products at important markets, and also contains special articles on the largest 1918 crop yield, stocks of potatoes on January 1, firewood used on farms, and other miscellaneous data.

**Annual statistics of Chile** (*An. Estad. Chile, 7* (1915-16), pp. [81+113]).—These pages continue data previously noted (*E. S. R.*, 37, p. 92), by adding later year.

**Statistics of trade and agricultural products in Spain, 1916**, M. MATEOS (*Mem. Estad. Renta Aduanas, 1916*, pp. 115).—This report gives data with reference to the production and internal and foreign trade in agricultural products for 1916, with comparative data for earlier years.

**[Agricultural statistics in Switzerland]** (*Statist. Jahrb. Schweiz, 25* (1916), pp. 281).—These pages continue information previously noted (*E. S. R.*, 36, p. 260), by adding information for a later year.

**Agricultural statistics of British India** (*Statist. Abs. Brit. India, 50* (1905-1916), pp. VIII+260).—These pages supplement information previously noted (*E. S. R.*, 36, p. 201).

### AGRICULTURAL EDUCATION.

**Plan for the organization and administration of the Smith-Hughes Act** (*Ore., Supt. Pub. Instr. [1917], pp. 14*).—This is a detailed statement of the plan for the organization and administration of vocational education in Oregon under the Smith-Hughes Act, submitted by the Oregon State Board for Vocational Education to the Federal Board for Vocational Education and adopted December 18, 1917, together with local plans for administering the same.

It has been arranged that the Oregon State Agricultural College will make a formal transfer to the State Board for Vocational Education of the time and services of its professor of agricultural education.

The plant and equipment of schools receiving Federal aid for vocational instruction in agriculture is to consist of a minimum of approved general equipment valued at \$500 for an all-day or department school, an approved reference library, ground sufficient for experimental and demonstration purposes, and an annual fund of not less than \$100 for incidental expenses. The minimum salary of teachers of vocational agriculture shall be \$1,200, in addition to an annual maintenance fund.

In an all-day school or department at least 50 per cent of the time is to be spent on vocational agriculture, including project work, the study of material bearing directly on the project, and the study of related material. There must be at least six months' supervised farm-project work, carried on upon a commercial basis.

The minimum qualifications of a teacher of vocational agriculture shall be (1) graduation from a 4-year standard agricultural college course with the major work in general agriculture, and not less than 15 semester hours of agricultural education comprising practice teaching, special methods in teaching, educational psychology, principles of education, and a study of vocations and the relation of agriculture to economic conditions; and (2) not less than 2 years of practical farm experience. He shall be employed for the calendar year with provisions for vacations, etc.

The training of teachers of agriculture will be done by the Oregon College under the supervision of the State Board for Vocational Education. The course



of study will include 50 per cent of technical agricultural studies, 15 per cent of agricultural education subjects, including practice teaching, 20 per cent of related and allied subjects, and 15 per cent in approved electives to make a well-balanced course. Not less than two years of practical farm experience is required.

All-day home economics classes or departments must be in session for at least 9 months in the year and not less than 30 hours in the week. The course will be so arranged that at least one-half of the time of instruction will be devoted to such phases as garment making, foods and cookery, sanitation and home nursing, house planning and furnishing, textiles, millinery, dressmaking, and home management. The minimum qualifications for teachers will be (1) graduation from a 4-year course in home economics, with not less than 15 semester hours in educational subjects, including special methods, practice teaching, etc.; and (2) not less than 2 years of practical teaching experience and sufficient practical experience in housekeeping to make the instruction practical.

A teacher of vocational home economics in part-time schools must be a graduate from a standard college or university with a degree in home economics, conforming to the State school law of Oregon on the certification of teachers, and have had sufficient practical experience in the trade to make the instruction practical. In the evening classes the teacher must be a graduate from a standard college or university, or hold a life State certificate or State diploma secured by examination before the State department. The minimum salary of the teacher of vocational home economics is \$1,000.

The training of teachers of home economics under this act will be done at the Oregon College under the supervision of the State Board for Vocational Education. By an arrangement for itinerant teaching, teacher-training will be carried on in the regular classes in the college and in evening schools in Portland. The course of study corresponds to that for teachers of agriculture but requires practice work in different departments of a practice household maintained on a practical housekeeping basis.

Vocational education (*Oregon Bd. Vocational Ed. Bul. 1* (1917), pp. 15-28).—This bulletin, which is combined with the plan for the organization and administration of the Smith-Hughes Act noted above, contains the general regulations of the State Board for Vocational Education.

A standard course in vocational agriculture for all-day or department students is to consist of 4 full years' or 16 units' credit, 15 units being required for graduation. A unit covers 2 hours a day for 36 weeks, or 360 hours a year. For practical work not requiring preparation, two hours' work is required for one hour's credit. No projects will be accepted as worthy of school credit which do not involve new experience and the acquiring of new skill for the student. I. e., projects to be acceptable must have educational value.

For instruction in home economics the State or local community, or both must provide an approved general equipment of not less than \$500 value, an approved reference library, a practice house of not less than 5 rooms with approved furnishings, and an annual fund of not less than \$50 for incidental expenses. Twenty pupils will constitute the maximum class or group of pupils to be instructed in home economic subjects by one teacher. A local advisory board is provided.

Report of the committee on teaching (*Amer. Farm Management Assoc. Rpt.*, 7 (1916), pp. 108-116).—This is a report previously noted (*E. S. R.*, 36, p. 297) on the status of advanced undergraduate teaching in farm management offered in 17 of the agricultural colleges.

**The fundamental relation of botany to scientific agriculture.** H. D. WAGNER (*School Sci. and Math.*, 18 (1918), No. 1, pp. 11-15).—This is a consideration of the fundamental relations of the scientific study of the plant to agricultural practices, in which the author urges that the thorough study of the fundamental structures and processes of plant life and the practical application of these scientific principles should form closely correlated courses for elementary students in agriculture. In his opinion this can be done without difficulty if the teacher of botany has sympathy for and knowledge of present-day agriculture and if the teacher of agriculture is familiar with the fundamental structures and processes of the plant.

**Teaching of agriculture in the rural schools.** F. C. HATHAWAY (*State Normal School and Indus. School [Ellendale, N. Dak.]*, Bul., 12 (1917), No. 1, pp. 55, figs. 1).—This is a series of 39 exercises planned to follow the order of the seasons and outlining the object, materials for, and method of studies of the seasonal structure of plants and their parts, weeds, wheat, potatoes, corn, soils, crop rotation and farm management, horses, breeds of dairy cattle, dairy sanitation, eggs and poultry. Suggestions for gardening and for a fly campaign, and references to the literature, are included.

**A manual of home economics for the rural school** (*Bul. State Normal School, San Diego, Cal.*, 4 (1916), No. 3, pp. 40, figs. 3).—This bulletin offers suggestions for teaching health and sanitation, sewing, foods and cookery, care of babies and young children, the keeping of household budgets, etc., in rural schools without equipment for home economics instruction and in which the teacher has no special training in the subject. Recipes, suggested equipment at minimum cost, illustrative reports from rural teachers of home economics on work done in their schools, and references to the literature are included.

**Suggestions for organizing and supervising junior home project work.** E. L. GARRIN (*Cornell Rural School Leaflet*, 11 (1917), No. 2, pp. 325-372, figs. 12).—This leaflet offers suggestions for the organization and supervision of junior home projects in elementary agriculture and home making in the State of New York, the plan of which has been previously noted (*E. S. R.*, 30, p. 896). References to the literature are included.

### MISCELLANEOUS.

**Report of Kansas Station, 1916** (*Kansas Sta. Rpt. 1916*, pp. 49).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, a report of the director summarizing the work and publications of the station, and one special article. The experimental work recorded is for the most part abstracted elsewhere in this issue.

**Twenty-eighth Annual Report of Kentucky Station, 1915, Part 1** (*Kentucky Sta. Rpt. 1915*, pt. 1, pp. IX+79, pls. 4).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, a report of the director on the work and publications of the station during the year, departmental reports, reports of analyses of mineral waters, and meteorological data. The experimental work recorded is for the most part abstracted elsewhere in this issue.

**Thirtieth Annual Report of Maryland Station, 1917** (*Maryland Sta. Rpt. 1917*, pp. XXVIII+347, figs. 49).—This contains the organization list; a report by the director on the organization, work, and publications of the station; a financial statement for the fiscal year ended June 30, 1917; and reprints of Bulletins 197-208, previously noted.

**How the station works.** F. B. MUMFORD (*Missouri Sta. Bul. 151* (1917), pp. 8, figs. 12).—This contains the organization list, a report of the director on

the work and publications of the station, and a financial statement for the Federal funds for the fiscal year ended June 30, 1917. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

**Twenty-eighth Annual Report of New Mexico Station, 1917** (*New Mexico Sta. Rpt. 1917, pp. 92, figs. 14*).—This contains the organization list, a report of the director on the work and publications of the station, including reports of heads of departments, and a financial statement for the Federal funds for the year ended June 30, 1917. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

**Thirtieth Annual Report of South Carolina Station, 1917** (*South Carolina Sta. Rpt. 1917, pp. 32*).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1917, and departmental reports, of which portions of that of the animal husbandman are abstracted elsewhere in this issue.

**Report of the Canada Experimental Farms, 1916** (*Canada Expt. Farms Rpts. 1916, vols. 1, pp. VIII+598, pls. 39; 2, pp. 599-1093, pls. 14; 3, pp. 1499, pls. 43, fig. 1*).—Volume 1 of this report contains the report of the director, including general notes, meteorological data, and synopses of the work of the various divisions, branch farms, stations, and substations, and reports of the divisions of chemistry, field husbandry, and animal husbandry. Volume 2 contains reports of the divisions of horticulture and cereals. Volume 3 contains reports of the divisions of botany, bees, forage plants, poultry, tobacco, demonstration stations, and extension and publicity. The experimental work reported is for the most part abstracted elsewhere in this issue.

**Monthly Bulletin of the Ohio Experiment Station** (*Mo. Bul. Ohio Sta. 1917, No. 12, pp. 385-419, figs. 4*).—This contains several articles abstracted elsewhere in this issue, together with one entitled Feeding Swine in Dry Lots by W. L. Robison, and notes. An index for 1917 is appended.

**Monthly bulletin of the Western Washington Substation** (*Washington Sta., West. Wash. Sta. Mo. Bul., 5 (1918), No. 10, pp. 141-156*).—This number contains brief articles on the following subjects: The Function of Grades and Standards in the Marketing of Farm Products, by A. Hobson; Varieties and Culture of Cane Fruits in Western Washington, by J. L. Stahl (see p. 647); Silage Crops for Western Washington, by E. B. Stookey (see p. 637); Very Early Hatches Pay Best, by Mr. and Mrs. G. R. Shoup (see p. 678); and Winter Work in the Orchard, by A. Frank.

## NOTES.

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**Connecticut State Station.**—Elijah Rogers, of Southington, and William H. Hall, of South Willington, have been appointed to the board of control, vice Frank H. Stadtmueller and H. W. Conn, deceased.

**Delaware College.**—R. V. Mitchell, professor of poultry husbandry, has been granted leave of absence to assist in poultry and egg handling studies in the U. S. Department of Agriculture.

**Iowa College.**—The college abattoir building has been completed. It is a spacious brick structure with a judging ring and seating accommodations for 100 persons. A killing pen, cooling rooms, cooking vat, and equipment for by-product utilization are also provided.

**Kansas College and Station.**—W. M. Jardine, dean of the division of agriculture and director of the station, has been appointed president, effective March 1. L. E. Call, head of the department of agronomy, has been appointed acting dean of the division of agriculture and acting director of the station. O. E. Reed, in charge of dairy husbandry work, has also been appointed State dairy commissioner, vice G. S. Hine resigned to accept a commercial position.

**Kentucky University and Station.**—Under a State reapportionment tax law, enacted by the recent legislature, the revenues of the university have been increased by \$200,000 per annum. Plans are under way for a material increase in the teaching staff and the undertaking of extensive repairs. The construction of new buildings is to be postponed for the present, but plans are being formulated for campus grounds under a permanent plan.

Dr. F. L. McVey was installed as president, June 4.

In the station, Dr. Philip L. Blumenthal, of the department of chemistry, and Owen S. Lee, of the department of fertilizer control, have been granted leave of absence for military service.

**Maryland College.**—The new agricultural building, costing \$175,000, was dedicated at Commencement May 30. F. A. Wirt, of the Kansas College and Engineering Station, has been appointed extension lecturer in farm mechanics.

**Minnesota University.**—A recent State law authorized the maintenance of experimental peat farms at Dibble, Goodridge, and Anoka. A tract has been secured for the farm at Goodridge. Arthur G. Tyler has been appointed assistant professor of farm engineering, vice L. R. Whitson resigned.

**Missouri University.**—L. F. Childers, extension specialist in soils, has been appointed emergency demonstration agent with headquarters at Fayette, beginning April 1. R. A. Kinnaird, extension instructor in soils, has been appointed agricultural agent for Clinton County. Miss Bab Bell, extension assistant professor of home economics, has resigned, effective March 9, and has been succeeded by Miss Essie Margaret Heyle. The resignations are also noted of John S. McDaniel, extension assistant professor of veterinary science, effective April 1, and Clifton R. Thomson and S. R. Miles as assistants in animal husbandry, effective April 6 and March 15, respectively.

Two-year certificates in agriculture have been awarded to a class of 20 students.

**Cornell University and Station.**—Dr. Lewis Knudson, professor of botany in the college of agriculture and plant physiologist in the station, has been granted

leave of absence to engage in Y. M. C. A. work in France. Lawrence E. ... has resigned as instructor in botany and has enlisted in the Coast Artillery.

**Ohio State University.**—The appointment is noted of L. O. Lantia, of the extension department, as instructor in rural economics.

**Porto Rico Federal Station.**—F. E. Kempton, Ph. D., University of Illinois, 1918, has been appointed pathologist.

**Tennessee University.**—Four tractor short courses of three days each were held during March and April at Knoxville, Jackson, Memphis, and ... The courses were under the supervision of the division of extension and the college of engineering of the university, the Food Administration, and the State department of agriculture, and in the Memphis short course the extension divisions of Mississippi and Arkansas and the college of engineering of the University of Arkansas cooperated.

**Virginia College and Station.**—The legislature made substantial increases in its appropriations for the biennial period ending February 20, 1920. The college will receive \$153,000 the first year and \$128,000 the second year, and provision is made for the establishment of a department of education. The extension division will receive \$30,000 each year, this being an annual increase of \$14,000. The extension division will receive \$76,191.57 the first year and \$92,191.57 the second year. The Crop Pest Commission and the Live Stock Sanitary Board will receive \$15,000 and \$12,500, respectively, each year.

A. B. Massey, assistant professor of botany and assistant botanist of the Alabama College and Station, has been appointed associate plant pathologist and bacteriologist, effective June 1.

**Canadian Instruction in Agriculture behind the Lines.**—A system of instruction has been organized in one of the divisions of Canadian troops in France and known as the University of Vimy Ridge. Lectures are given to the groups on subjects selected to equip men in active service for "greater efficiency in business, the professions, agriculture, and other great industries of the Dominion." Classes are organized for smaller groups, and individual instruction for more advanced students with recognition and credit on their return to Canada for work accomplished. It is also planned to obtain in this way an organization and staff which will be prepared to devote its attention to educating the soldiers during the interval which may elapse between the cessation of peace and their return to Canada. Agriculture, applied science, and vocational branches are among the subjects to be taught in this way.

What is known as Khaki College has subsequently been organized. The work is carried on farther back of the lines than the foregoing and is conducted on a somewhat more elaborate and permanent basis. A chancellor and senate have been appointed to serve as the governing body, together with what is termed an executive faculty, consisting mainly of heads of departments. Certificates of proficiency are issued by the college on the recommendation of heads of departments.

Eight departments have been arranged, among which is agriculture. Lieutenant P. Stewart, formerly district supervisor of agriculture in New Brunswick, has been given charge of the work in agriculture, which also has two lecturers on animal husbandry, and one each on field husbandry, horticulture, farm bookkeeping, agricultural English, and poultry.

Khaki College has been under way about six months. Over 900 students have been enrolled and about 370 took the first examination.

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